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# illinois technograph

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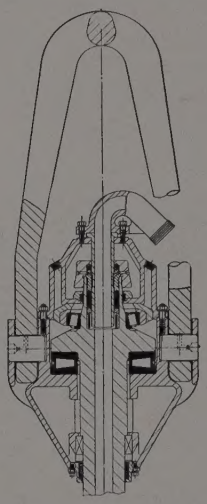
*Another page for* **YOUR BEARING NOTEBOOK**

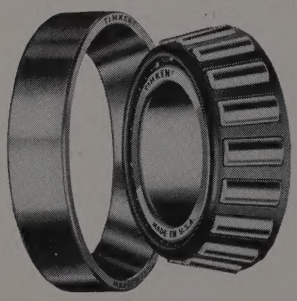
## How to keep a drill team from marking time

The swivel on a drilling rig has to carry the tremendous weight of drill pipe that's often three miles long. To carry this load while permitting the pipe to rotate as fast as 250 R. P. M., oil equipment design engineers use Timken® flat thrust bearings in the swivels. Due to line contact between rollers and races, Timken bearings have extra load-carrying capacity. True rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction and wear. Costly breakdowns are prevented.

## How swivels are mounted on TIMKEN® bearings

The Timken bearing used to carry the thrust load in this typical swivel is an on-apex thrust (type TT) bearing. A single-row (type TS) Timken bearing is used at the top position. Bearing adjustment is made with thin metal shims between the cup carrier and the swivel housing.





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# the illinois technograph

**volume 67** **number 6**

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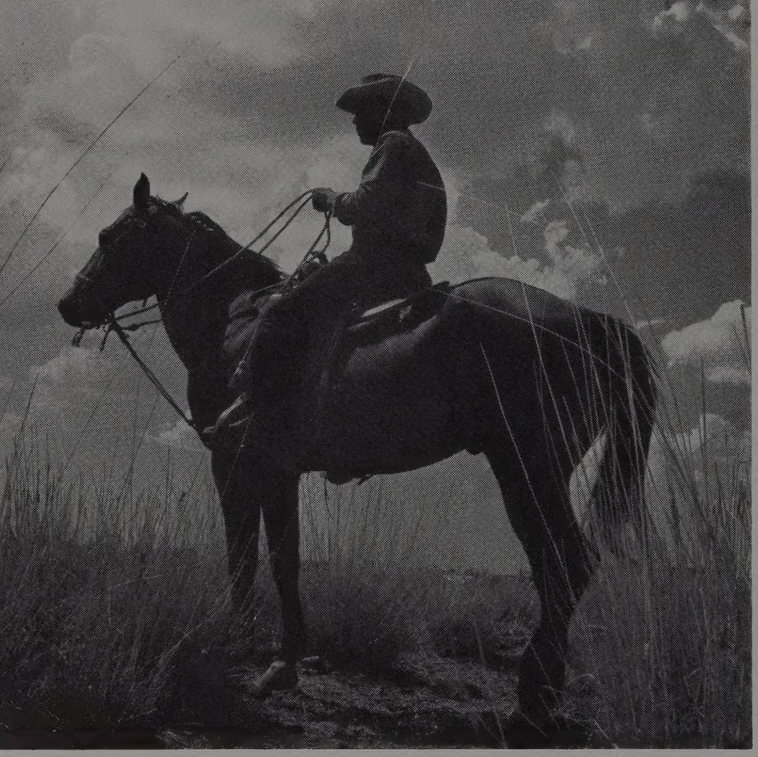
## *our cover*

Here is a scene typical of almost any farm in the United States today. It illustrates the tremendous role the agricultural engineer has played in bringing machinery and technological advancement to the American farmer. Through agricultural engineering the United States has been able to increase farm production far beyond the expectations of our forefathers. (Courtesy CASE EAGLE, J. I. Case Company)

Our new cover designed by Lee Siple.

## *our frontispiece*

The "Sentinel of the Plains" still has an important job although he is replaced by the automobile, jeep and airplane in many places. We acknowledge our indebtedness to the pioneer spirit exemplified in this picture by reviewing the contributions to agriculture and the range made as a result of their necessities. (Courtesy HARVESTER WORLD, International Harvester Company)



. . . We have only so much land on which to produce crops and livestock. Improved varieties of crops have been developed, the yields from which are far beyond the yields from the same crops in previous years. Soils have been put under terrific strain in the process, and lands have gone out of production for one crop and into production for another. Some lands have been abandoned altogether through misuse.

Others not previously used have come into production, either wisely or unwisely. But the fact remains that we have only a certain acreage of agricultural or potentially agricultural land available in the United States. This, in the face of a steadily increasing population, makes one thing sure: Future research must, above all, keep in mind the need to feed and clothe more and more people from a limited over-all acreage. The problem of land use, therefore, becomes paramount. They call for the best of scientific approaches. . . .

R. W. Trullinger in the 1950-51 Yearbook of Agriculture

*ever-increasing opportunities in . . .*

# Vocations in Ag. Engineering

**by Cerwyn Kline**

Men who have chosen the agricultural engineering profession are often sked, "Just who are the agricultural ngineers and what do they do?" To hose who are embarking on a career n this branch of engineering the anwer to this question provides an insight nto the revolution of an industry. In ess than half a century, this occupation as crystallized from the ideas of a few nen, blossomed into a practical and echnical science, and matured into a ecognized professional branch of engieering. The potentiality for service of his group of engineers has just begun o be realized. The wide range of fields equiring technical engineering assistnce offer ever-increasing opportunity or development and advancement. Now hat the ground work has been laid nd professional recognition obtained, gricultural engineers are limited only y their own foresight and imagination. Their predecessors have come a long vay, but no forward looking agriculural engineer today doubts that this s only the preliminary step in a most romising field of professional activity nd service.

Agricultural engineering is a comosite branch of engineering, based upon he principles and utilizing the techiques and tools of many of the other ngineering groups such as mechanical, ivil, and electrical engineering. At the ame time, agricultural engineering is haracterized by its application to a sinle industry and is in this way similar o mining and automotive engineering. Unlike the other engineering branches, t must deal with the living biological orces of nature, as well as with the nanimate dynamic forces with which ngineers are customarily concerned.

We have, today, new concepts of arm management, work simplification, he one-man farm, productive capacity, uality control, soil and water conseration, and a host of other ideas and ractices which have made a more stable nd more prosperous agriculture. Without the benefits of increasing agriculural production our nation would never ave become the world power it is today.

When an agricultural engineer gradates from college, what can he expect o do? Who are his prospective emloyers? What are some of the fields n which agricultural engineers are well established and what are some of the newer activities in which an agricultural engineer might find employment? Agricultural engineers are employed in a surprisingly large range of activities. The following excerpt taken from an editorial which appeared in the *Agricultural Engineer,* will indicate the great diversity of positions open to agricultural engineers.

"A substantial number of members are employed in trade associations and individual companies in the engineering materials industries. The industries thus represented and interested in improving their service to farmers include aluminum, copper, brass, bronze, lead, nickel, steel, and zinc in the metals group, and asbestos, brick, limestone, glass, gypsum, petroleum, portland cement, tile, and vermiculite as well. The lumber, fiber, paints and coatings, and chemical industries can also be included in this group. Others may show up in the future.

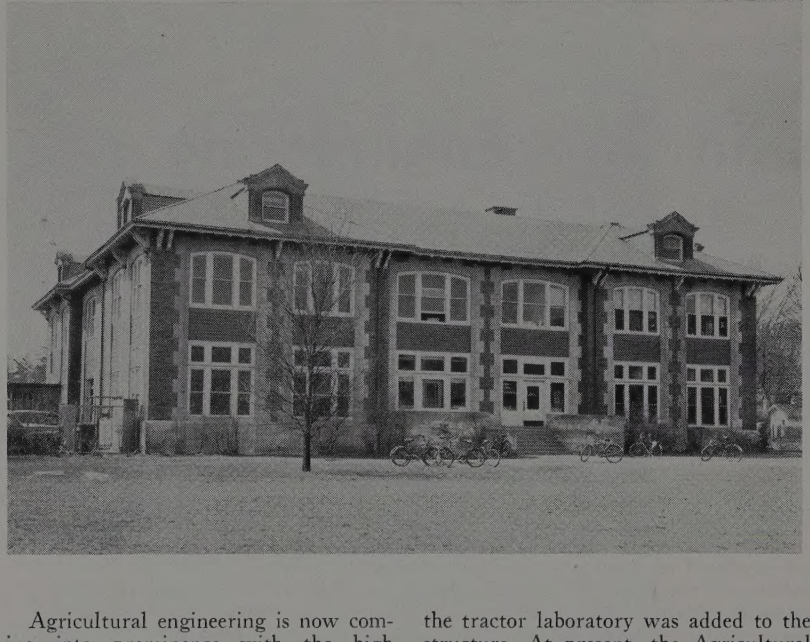
The farm equipment industry is a natural place for their employment, in which agricultural engineers have proven their ability and earned increasing acceptance over a period of years. Still, there are quite a number of the smaller manufacturers who employ no agricultural engineers, or not enough of them to do their job. They include manufacturers of prime movers, small tractors, tillage equipment, pumps, irrigation equipment, harvesting and handling equipment, crop driers, prefabricated building and bins, pest control equipment, refrigerators, barn equipment, fans and blowers, and miscellaneous specialized items.

In the component parts classification, leading manufacturers of bearings, chains, tires, and wheels have members keeping a watchful eye on progress in the agricultural engineering field, and contributing to that progress. A token representation from the electrical manufacturing industry is doing the same.

Of more than 70 public utilities having agricultural engineers helping them serve their farm customers, more than half have only one each, and most of the rest have only two, three, or four.

(*Continued on Page* 18)

One phase of an agricultural engineer's studies is the testing of lubricating oils used for farm machinery. (Courtesy of Hadley Read)



# *the Technograph features the . . .*

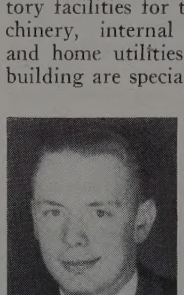
Agricultural engineering is now coming into prominence with the high degree of mechanization in agriculture. The agricultural engineering department at the University of Illinois is sharing in the growth of importance of the field of agricultural engineering.

The department has a current enrollment of about 50 students, well above the pre-World War II record. Also, a greater proportion of engineering students are enrolled in this department (about three per cent) as compared with one and one-half per cent of the engineering students enrolled before 1948.

The department is unique in the fact that it is a part of two colleges, engineering and agriculture. The department is administered in the college of agriculture and is a unit of the college, the Agricultural Extension Service, and the Agricultural Experiment Station. The professional curriculum is administered by the college of engineering and degrees are awarded upon authorization of the engineering faculty.

The department has been in the college of engineering since 1933, although the University of Illinois had a "professor of agricultural engineering" in the 1870's. Prior to 1900 and until 1922, the division of farm mechanics was in the department of agronomy. In 1922, it became a separate department. In 1933, it became the department of agricultural engineering and at that time the degree was authorized. In 1948, the master's degree in agricultural engineering was authorized and a series of graduate courses for students with degrees in agriculture were authorized in 1951.

The building in which the department is housed was constructed in 1905-06 as the Farm Mechanics building. In 1922, the tractor laboratory was added to the structure. At present, the Agricultural Engineering building contains the offices, laboratories, and classrooms of the department. In addition to the tractor laboratory, the building contains laboratory facilities for the study of farm machinery, internal combustion engines, and home utilities. Also located in the building are special research laboratories and a drafting room for design work.



HOWARD HADLER

**Howie, a sophomore in agricultural engineering, is a life-long resident of Rantoul, Ill., and a graduate of Rantoul Township high school. After graduation and probably a short session with Uncle Sam, he hopes to get into industrial machinery work or go back to farming, which is his present summer occupation.**

**Besides being a member of the Tech staff at Illinois, he is active in the ASAE.**

**His hobbies—intermittent airplane modle building and general tinkering.**

In the tractor laboratory are several farm tractors and engines of the latest design. These tractors and engines are used for classroom work and performance testing. The laboratory also houses a dynamometer for the testing of tractor and engine power. Late models of all types of farm machinery are kept in the farm machinery laboratory and are used for study of machine components, principles, and design. One laboratory is devoted to research work on tractor valves. In other laboratories are electrical equipment of various kinds and other equipment for classroom work.

At present the building is highly overcrowded. To provide more space, a new research laboratory is being built. Construction of the building was started in the fall of 1951. The new building is a one-story structure, 45 by 200 *ft*. It will provide 9,000 square feet of research space for the department's extensive research and will be comparable in quality with other new buildings on the campus.

The department currently has 30 academic staff members. Professor E. W. Lehmann has been the department head since 1922. Professor R. I. Shawl has been with the department more than 30 years. Mr. H. P. Bateman was a member of the first graduating class, in 1934.

The department offers a four-year curriculum leading to a degree of Bachelor of Science in agricultural engineering with options permitting the student to choose between a power and machinery, farm structures, or soil and water engineering curriculum.

The power and machinery option includes the design of machines, the application of machines to farm use, and the development and use of materials for construction of machine components. The farm structures study includes study of design, location, and arrangement of buildings; lighting, heating, ventilation, and functional requirements of farm buildings. Soil and water engineering includes drainage, soil erosion control, irrigation, land clearing, and flood control. The power and machinery option follows the mechanical engineering design course closely, and the farm structures and soil and water engineering option includes civil engineering design. Courses are offered in the fourth major field in agricultural engineering—rural electrification. Included are electric service to rural areas, and the development and use of farm machinery and equipment involving electricity.

The agricultural engineering curriculum follows the common freshman engineering program of study in the first year. In the second year, the study program begins its specialization, and in the third year, the student chooses between one of the two options offered. The program of study is so arranged as t

# Ag. Engineering Department

by Howie Hadler, ag. e. '54

give the student a thorough groundwork of basic engineering courses which are necessary in any engineering field, along with specialized courses necessary to the particular field and agriculture courses needed to give a thorough understanding of problems in agricultural engineering.

In addition to the four-year curriculum in agricultural engineering, the department also cooperates with the college of agriculture in a five-year plan leading to degrees both in agriculture and agricultural engineering. The department also offers many courses to students in the college of agriculture. Beginning in the fall of 1951, winter and short courses were offered, as were extramural graduate courses.

As a part of the Agricultural Experiment Station, the department carries on an extensive research program. Most of the staff members give all or a major part of their time to the research program.

The scope of the research program is varied, but is centered mainly in the four primary divisions of power and machinery, rural electrification, farm structures and housing and soil and water engineering. Part of the work is cooperative with other states in the North Central region; with the Department of Home Economics; and with the U. S. Department of Agriculture. The contract study is being handled for the U. S. Department of Agriculture Regional laboratory of Peoria. Several studies are supported by industrial organizations that provide about $25,000 a year for certain research projects.

In power and machinery research, the work includes study of tractor valves, use of alcohol-water injections, spray equipment, sunflower harvesting, and development of other machinery and equipment for more efficient operation. A 60-acre tract of farm land is operated in conjunction with the projects.

The principal rural electrification study is centered on the development of automatic equipment controls and the methods for feed handling, mixing, grinding, and distribution to livestock. Other work deals with ventilation, and building environment.

Farm structures and housing research emphasizes labor efficiency, production requirements, fire and wind loss prevention, utilization of materials and improved construction methods. Extensive work is done on farm housing, particularly to develop farmhouse plans and planning methods.

Soil and water engineering research covers such studies as drainage of plastic till soils, surface irrigation, water runoff, design of conservation structures, and surface water supplies.

Over the years, the department has pioneered in the study of problems that contribute much to engineering in agriculture. Some examples are initial work on hay crushers; studies in handling and storing soft corn; preliminary work on hay drying and crop conditioning; early installation of the high-compression head on farm tractors; experiments with the use of combines in the humid region.

The research program contributes much to the extension service of the department. The extension service of the agricultural engineering department is under the college of agriculture Extension Service. The extension service publishes many bulletins and circulars for information to farmers and others working in the field of agriculture. Much of the information for these bulletins is obtained from research projects and research investigation. The farm buildings branch of the department sells at cost an average of better than 1,000 farm building plans per month. Many of the plans are the result of research in farm building design.

Five men in the department give full time to the extension program with help from other staff members. The program is varied and includes all lines of subject matter with most emphasis given to demonstrations, county meetings, 4-H club projects, and short courses. The main purpose of the extension program is to supply the farmers with the most

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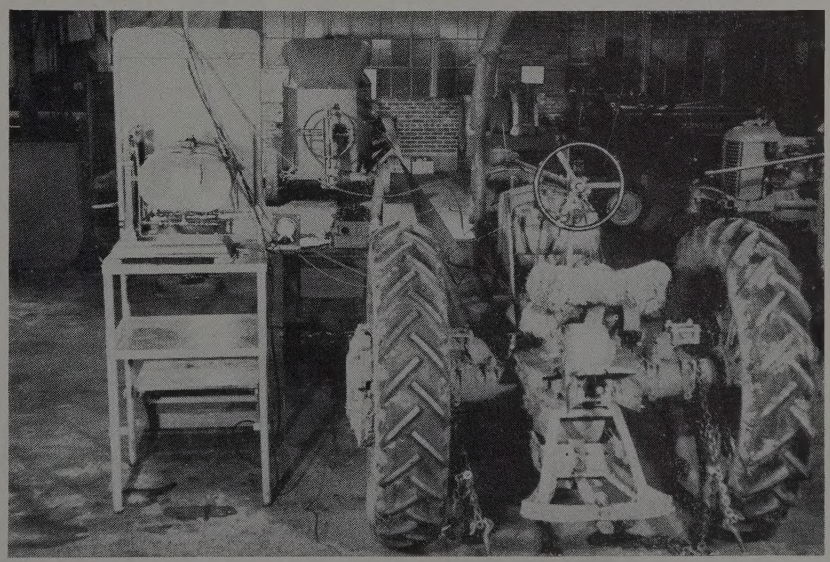


A view of the tractor laboratory showing a tractor ready to be tested on the dynamometer with other tractors and equipment in the background.

# introducing . . .

**by Tom Madden, m. e. '54, Oliver Smith, m. e. '54 and Lee Grossman, m. e. '53**

### EDWARD FORT

Edward Fort, a senior in mechanical engineering at the University of Illinois, graduated from Stronghurst High School. He started his professional training at the University of Cincinnati where he enrolled in a co-op plan which consisted of attending school and working on alternate semesters. Upon completion of his freshman year, Ed transferred to Illinois and enrolled in the mechanical engineering curriculum.

While here at Illinois he has been active in extracurricular activities and at the same time has attained an enviable scholastic record. Ed's main interest in mechanical engineering is in internal combustion engine testing and prime movers. He is working for Professor Hull in the M.E. Internal Combustion Laboratory as assistant, mechanic, and general helper. This actual

EDWARD FORT

work with the engines, he feels, is invaluable experience that will be of great use after graduation. Ed received the Scholarship Key for being in the upper three per cent of his class for the last four semesters, and also was initiated into Pi Tau Sigma—which he was president of last semester, Sigma Tau, and Tau Beta Pi engineering honoraries. Among extracurricular activities directly connected with the University, he was a demonstrator for the last I SEE and is publicity chairman for the 1952 Engineering Open House committee.

Ed has one hobby that stands out in importance over all of the rest and that is golf. In fact he is such an avid golfer that he arranges his class schedule so as to have two or three afternoons a week free to pace the greens.

Upon graduation he will receive a commission in the Navy to do engineering work as a naval officer. Just what type of work or where it will be is still a mystery to Ed. Job offers from private industry include a position testing fuels at the Ethyl Company.

The *Technograph* this month salutes Ed Fort, engineering student extraordinary, and wishes him the best of luck for a prosperous future.

### DAVID HARRIS

Another of the amiable personalities in attendance at the undergraduate division of the University of Illinois is David Harris, better known to his friends as "Dave."

Of farmer parentage, Dave received most of his elementary education in a country school. When his folks retired and moved to Bardolph, Illinois (another "wide spot in the road") Dave transferred there to complete his grammar school education.

While in high school, Dave took an active part in extracurricular activities in the way of sports and student functions. Also, as in the case of many individuals living in farm areas, he participated in 4-H club functions and later joined the Future Farmers of America.

Not long after graduation from high school, Dave was sent on a free trip half way around the globe through the courtesy of Uncle Sam. During the 18 months in the Infantry, he saw service with the occupational forces in Korea prior to the communist invasion. Upon discharge he enrolled in the U. of I. and began his career.

Being another of those whose interests lies in the farming field, Dave entered the curriculum of agriculture. Attaining a high scholastic average he has since been admitted to the Tau Beta Pi honorary engineering fraternity.

A member of the American Society of Agricultural Engineers, this popular gentleman has served as secretary and vice president. He was elected to presidency last fall and is now serving in that capacity until he graduates in June. In addition to being president of the society he is also on the committee for the publication of the twentieth anniversary issue of the ASAE Annual.

Besides all his other activities, Dave still finds time to belong to Triangle fraternity.

While attending college, Dave has chosen summer work of a nature similar to his selected field. For the past two summers he has worked with the Federal Soil Conservation Service on some of their projects. This is partially the

DAVID HARRIS

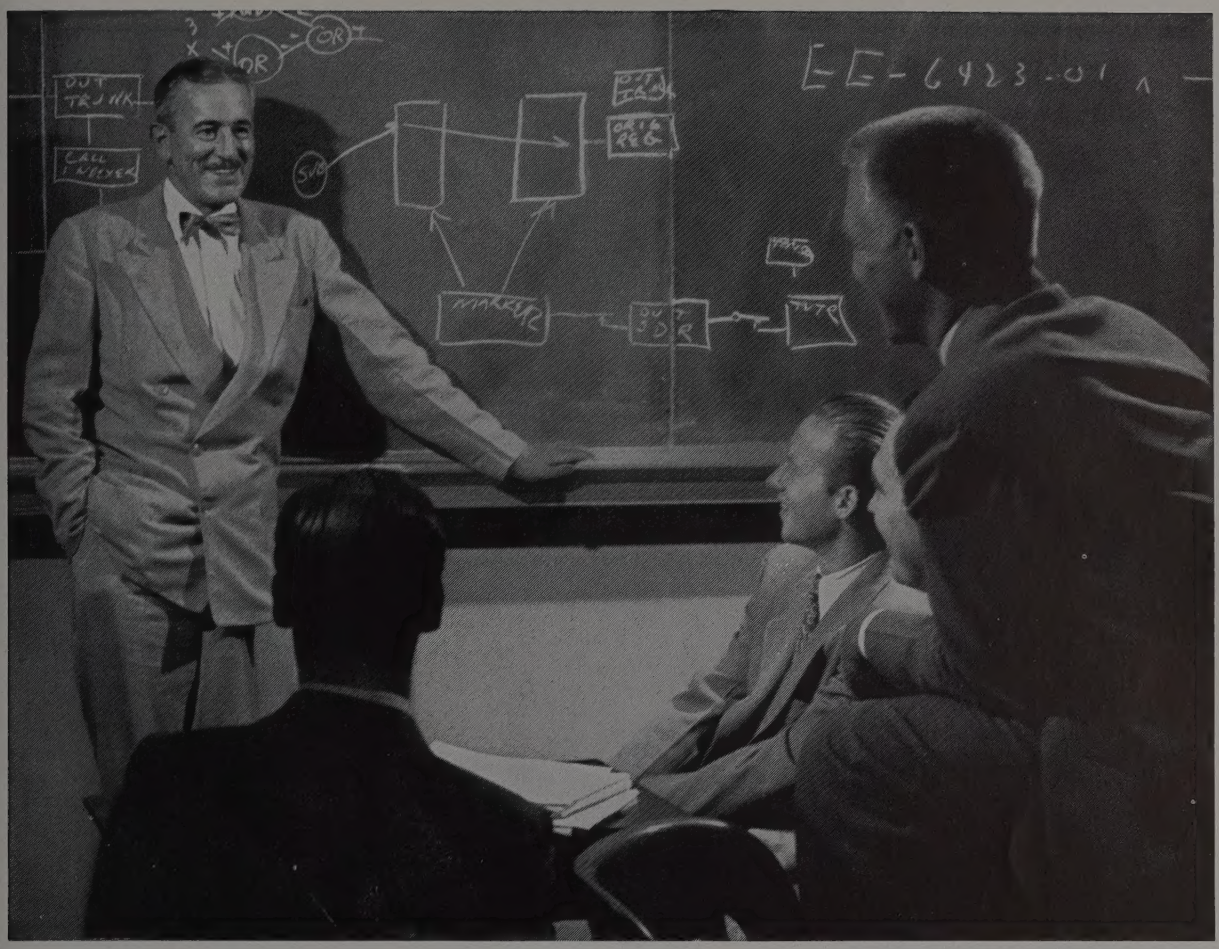
reason for his choice of soil and water conservation in addition to farm electrification for his options.

Dave has no positive plans for the future in the way of employment but thinks he might be attracted by one of the offers he will get during this (his last) semester. He hopes eventually to become a consulting engineer. One thing that is certain, which he related with no secrecy to this writer, is a sincere contemplation of marriage upon graduation.

### HARRY P. BATEMAN

South of Green street and even further south than the Commerce and LAS campus, one is apt to find that

(*Continued on Page* 24)




*In classes like this at the Bell Telephone Laboratories' school for communications development training, college graduates study electronics, oscillations and waves, switching and transmission.*

## THEY'RE HEADED FOR NEW FRONTIERS

Each year the Bell System selects hundreds of college graduates to learn how to develop, maintain and administer our country's telephone system. Thanks to the competence of our nation's professional educators, these graduates come with an excellent grounding in fundamentals.

Those specially fitted for research, work in the Bell Telephone Laboratories to develop tomorrow's telephone service. In the Western Electric Company, others are planning manufacturing processes or supervising production operations. And in the Bell operating companies, still others are engaged in the engineering and administrative side of telephone service.

More than ever, America's future must depend on men and women who are trained to think far ahead. They are needed both in technology and in administration.

By joining forces with such people, and helping them progress, the Bell System works to keep America's telephones the world's best, and to help the armed forces keep our country safe.

**BELL TELEPHONE SYSTEM**

*interference-free TV reception with . . .*

# U H F - T V

**by Ken Kolence, physics '53**

It's the year 2000, and as you hand out the drinks, one of your guests looks at his watch and remarks, "Say, isn't it almost time for the Illinois-Michigan football game?" And indeed it is, so you turn on your television set, sit back, relax, and wait for your set to warm up. In a few seconds the picture springs into full focus—only it isn't exactly a picture, it's more like a little stage, reproduced in full color. And as we sit back, enjoying the football game on your modern three dimensional television screen, let us look back 50 years to the development that has made all this possible.

By 1948, it had become evident that overcrowding was becoming a serious problem in that portion of the radio spectrum used for standard TV broadcasting. This portion, known as Very High Frequency (VHF) only provides

This UHF-TV converter can be installed on all existing television sets. (Courtesy of RCA)

enough space for 12 regular channels within a given area. Thus, in order to provide for interference-free reception, the Federal Communications Commission froze the construction of all new VHF television stations until new spectrum space could be found for use by the rapidly growing television industry.

In late September of 1948, TV broadcasting represented a troublesome paradox. At that time, only 40 commercial stations were in operation, and they were all losing money. Yet, in certain heavily populated areas, all available channels had been filled, and the FCC had authorized construction of 84 new stations. In addition, there were 300 other applications still pending. Thus, at that time, the FCC held a hearing with the intent of exploring the possibilities of television in the Ultra High Frequency (UHF) range.

It was at this time that it was first brought out that the field strength required for UHF television would be 10 times that of the standard VHF field, with the coincident requirement for a tube capable of a power output much higher than any previous tube of this type. Consequently, the opinion resulting from this hearing was that it would be from one to three years before commercial UHF television would be feasible. However, it was disclosed that, in nearly all other respects, UHF range was equal to or superior to the VHF band for television. With this last result in mind, an intensive program of tests and experimentation was begun by the television industry in an attempt to perfect commercial UHF television.

To understand the difference between VHF and UHF, and to further understand the importance of UHF, it might be well to look for a moment at the radio spectrum, as designated by the Federal Communications Commission:

| | |
|---|---|
| Very low frequencies | 10 to 30 kilocycles |
| Low frequencies | 30 to 300 kilocycles |
| Medium frequencies | 300 to 3,000 kilocycles |
| High frequencies | 3 to 30 megacycles |
| Very high frequencies | 30 to 300 megacycles |
| Ultra high frequencies | 300 to 3,000 megacycles |
| Super high frequencies | 3,000 to 30,000 megacycles |

In terms of actual wave length, the higher the frequency, the shorter the waves. Thus, in the medium frequencies, which are used for transoceanic wireless service, the radio waves are up to 10 miles in length. In contrast, the wave length of television channel 2 in the VHF band is just under 18 *ft*, channel 12 about 4½ *ft*, and in the UHF band, the wavelengths vary from 2 *ft* down to 13 *in*.

At a point just below the VHF band, extremely long distance communication is possible, but in the VHF band itself the limit of communication becomes the horizon as seen from the top of the antenna tower. The cause of this is in the strange actions of the ionosphere, which lies about 200 miles above the earth's surface. The ionosphere plays a big role in long distance short wave broadcasting, for they are

**KEN KOLENCE**

**Ken, a junior in LAS physics, hails from Waukegan, Illinois. Graduating from Waukegan Township high school, he originally enrolled at Lake Forest College before coming to Illinois.**

**At the present time, Ken is busy working on the physics exhibit for the 1952 Open House. He is also scholarship chairman of Chi Psi social fraternity and a member of Phi Eta Sigma, freshman honorary fraternity.**

reflected back to the earth's surface—thousands of miles from their origin—by this layer. Waves in the VHF band and higher, on the other hand, are so short that they pass right through the ionosphere. Thus, as far as the engineers are concerned, the only important waves transmitted via VHF or UHF are those that travel in a straight line. This is why the range of the telecast is limited, being dependent upon the height of the antenna tower as well as the power of the transmitter.

But despite these limitations, the higher frequency bands provide us with the only practical means of broadcasting TV. The answer to this seeming paradox can be found in the fact that, in the layman's sense of the word, television is a big user of spectrum space. An ordinary black and white television channel requires six megacycles of the radio spectrum. This is actually more than the first three divisions of the radio spectrum combined, and it would appear at first glance that each channel represents a major portion of the spec-

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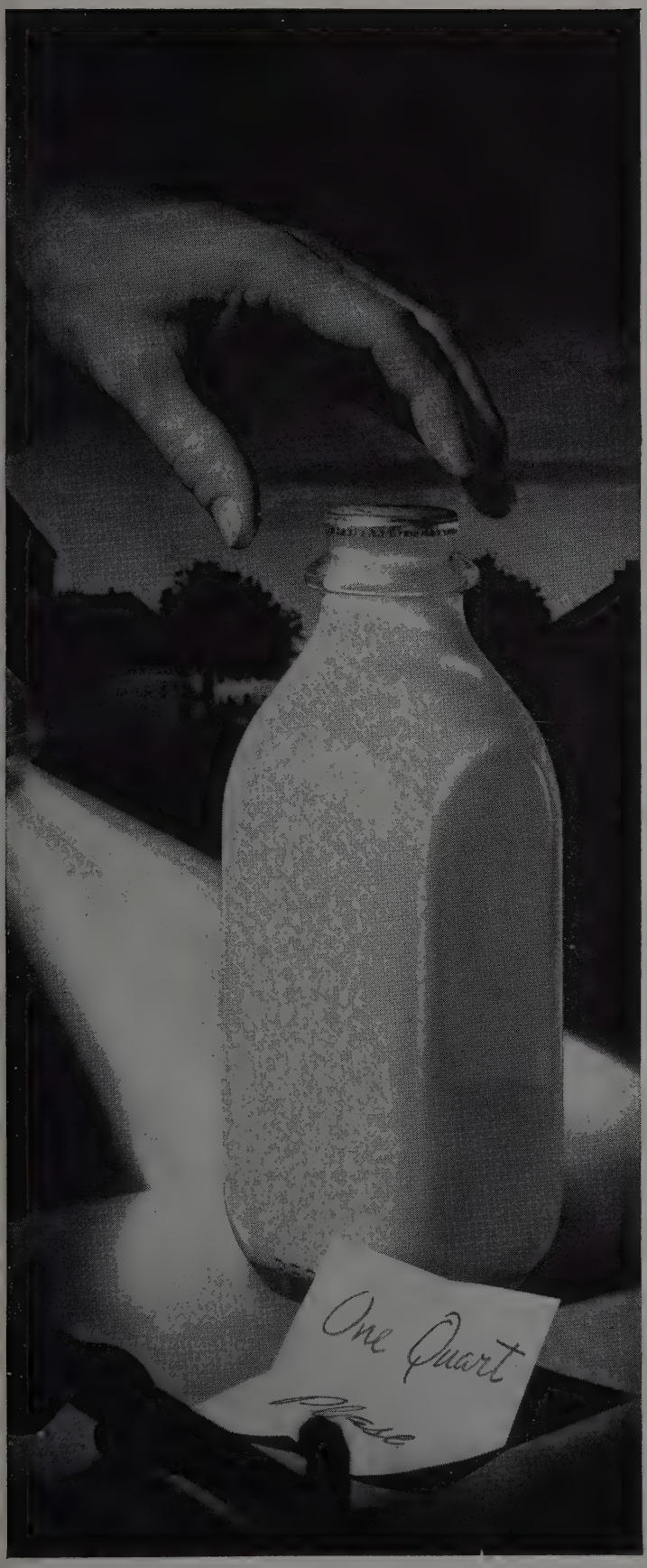



# 5 a.m.

A bottle of milk is the last scene in the last act of the cow-to-cup drama.

The real stars in this drama are milking machines, pasteurizers, bottle washers, homogenizers, and delivery trucks. Synthane—a laminated plastic—plays an unseen but essential part in these and other kinds of electrical and mechanical dairy equipment.

The dairy industry appreciates, as you may, the fact that Synthane is strong, light in weight, chemical-resistant, easily machined, and a good electrical insulator—all rolled into one. And that it is available in sheets, rods, tubes, and fabricated parts.

Try Synthane laminated plastics yourself. There is an interesting 26-page catalog of its properties and possibilities waiting for you. Synthane Corporation, 1 River Road, Oaks, Pennsylvania.

AIRCRAFT electronics system part, made from Grade LE Synthane. Application requires good electrical properties, resistance to moisture, retention of size and shape at elevated temperatures.

*Synthane-one of industry's unseen essentials*

**SYNTHANE**

LAMINATED PLASTICS

# skimming industrial headlines

edited by Howie Hadler, ag.e. '54

## radiation-detection devices

The atomic age requires special instruments. Already several types of radiation-detection (radiac) devices have appeared as a result of both the peaceful and military aspects of nuclear energy. Two portable types, each completely self-contained and weighing about 11 *lbs*, are being developed for the Army and the Navy. One employs the ionization principle, as distinguished from the familiar Geiger counter. This type of radiac gives a true measure of Roentgen energy from 0.08 to 2.0 million electron volts over the entire spectrum, which the Geiger counter cannot do. The new instrument has the extraordinary range of six decades, from 0.005 Roentgens per hour to 500 Roentgens per hour, which latter extreme intensity might follow an atom bomb disaster. The readings are provided as indications on a special change-scale instrument, not as clicks heard in earphones. Although the range is extremely broad, the accuracy is as good at the low settings as the higher ones. The electrometer principle employed has a longer time constant than other principles, which means the indications are not quite as rapid.

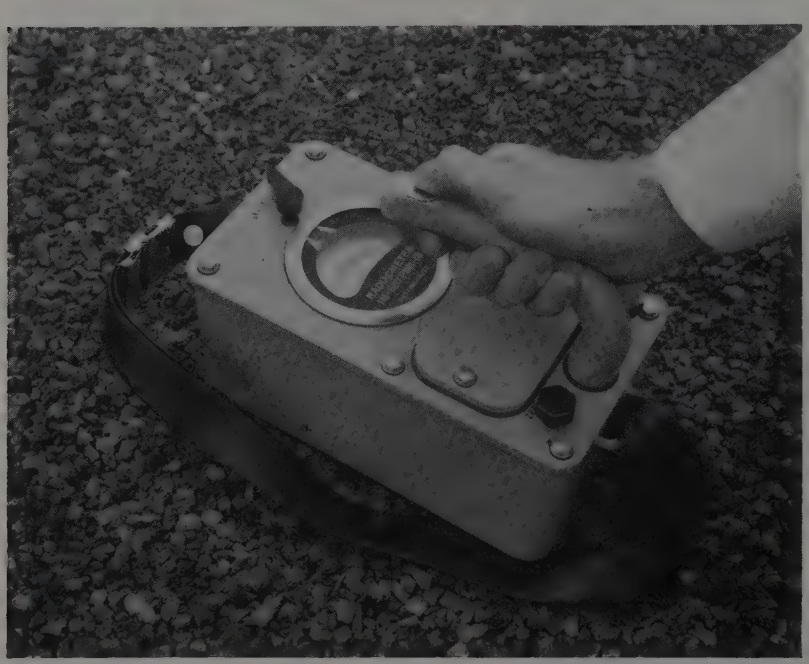
The other portable radiac employs a newer principle—developed by Westinghouse—that of photoelectric detection and multiplication of the light given off by phosphorus struck by the nuclear radiation. It is a little faster in response than the ionization-chamber type, very easy to use, and its warm-up time is less but it is not as sensitive. It is direct reading too, but only for the four higher ranges—from 0.5 to 500 R per hour.

In great contrast to these one-man, portable radiacs is a system of radiation detection for an area in which several detectors transmit signals to a central point where they are separately indicated, totalized, and running record made on tape.

Another type of radiac still undergoing development is a compact unit for installation in military planes. It will give the pilot a visual indication of danger should his plane enter a zone of strong radiation.

## underground tank

A new vehicle which operates like an Army tank has been developed by G-E for use in shuttling coal from veins to coal cars far beneath the earth's surface.



This newly developed radiation detector is completely self-contained and can be easily handled by one man. (Courtesy of Westinghouse)

Equipped with treads similar to those on an Army tank, but having a much lower silhouette, the "shuttle car" is powered electrically, and its "extension cord" or power cable is plugged into an outlet in the same way household appliances are. The 600 *ft* of cable are automatically reeled in or out as the car travels.

Coal is first loaded on the car deep in a vein by miners or by automatic mining machines. Then the car carries its load to the main tunnel and transfers it to small railroad cars or belt conveyors which then take the coal to the hoists or to the surface.

The car has a snout, which it can raise or lower, from which it disgorges its load by means of a continuous conveyor belt.

Because of its treads, the new vehicle can turn in a tight circle simply by locking one track and going ahead on the other. The treads also enable the car to carry a larger load than the conventional type equipped with wheels. Clearance pockets for the tires on conventional type shuttle cars cut down coal capacity. In addition, the wider conveyor belt made possible by the elimination of wheels, results in faster unloading. The vehicle can carry up to 10 tons of coal. It is about 22 *ft* long, 8 *ft* wide, and 3 to 4 *ft* high, and is built for either left or right-hand drive.

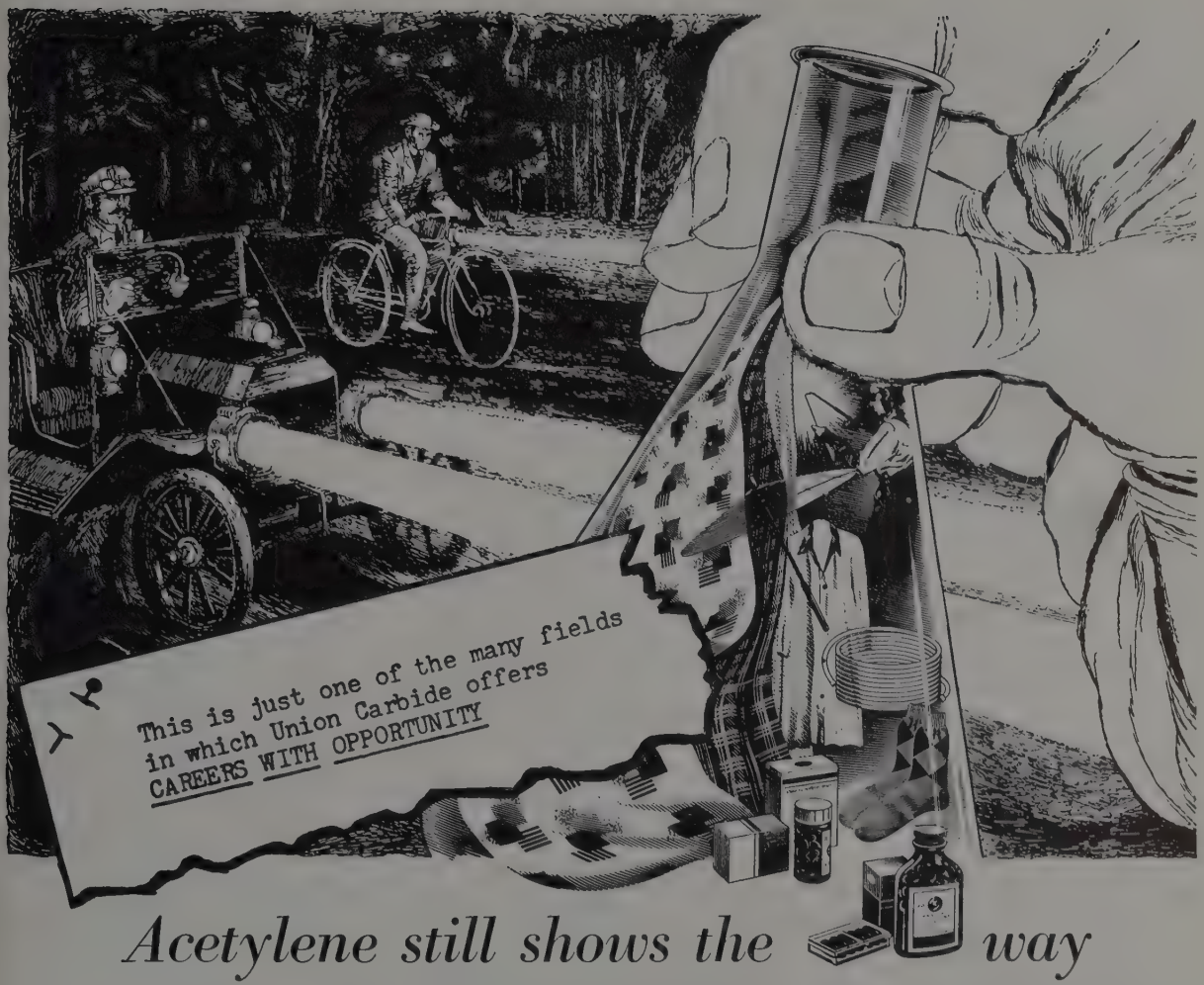
## new searchlights

The 24-*in* carbon-arc searchlight, as is standard equipment on some of the Navy's vessels, has been considered a well-developed, tried-and-tested device for many years. However, nine years ago development began on an improved model that is now superior to any previous model. The beam candlepower of the newly developed searchlight is 50 million as compared with 26 million beam candlepower of the older models. And all this is done with current input increased only from 70 to 105 amperes.

Part of the gain in output comes from improved carbons developed by the National Carbon Company. Also, an arc structure in which the carbons burn at almost a 90° angle, instead of the former 16° or 23°, enables it to keep out of its own light; the area of the mirror obscured by the arc mechanism has been cut from over 20 per cent to less than 5 per cent.

An entirely new control maintains a

(*Continued on Page* 28)




# *Acetylene still shows the way*

**Your nicest textiles—as well as vitamins, headache remedies, plastic garden hose, or welding on your car—may stem from this versatile gas**

**FORTY YEARS AGO** acetylene gas made from calcium carbide was used for home and street lighting, and was in common use for bicycle and automobile lights. Though these old lights have long since gone out, acetylene has gone on to chemical greatness.

**IN CHEMICALS**—Today, acetylene is the parent of hundreds of chemicals and chemical products used to make plastics, insect sprays, vitamins, aspirin, sulfa drugs and many other things.

Acetylene is the source of some of the basic chemicals in *dynel*, the new wonder textile fiber. It also goes into the Vinylite plastics used in beautiful home furnishing materials, protective coatings, and a host of other products.

**IN METAL FORMING**—In the production and use of metals, acetylene teamed up with oxygen has revolutionized many industries. From mines-to-mills-to-manufacturer, you will find oxy-acetylene cutting, welding and metal conditioning.

**50 YEARS OF PROGRESS**—The people of Union Carbide have produced acetylene for over half a century. Through continuous research they have made many remarkable acetylene discoveries important in the lives of all of us.

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**by Bob Schrader, ch.e. '54**

The president of the New York State Society of Professional Engineers, H. Gregory Shea, has gone on record as saying that more efficient use of engineers in industry and public projects could increase their availability for engineering tasks as much as 50 per cent.

In analyzing the current nationwide shortages of engineers, Mr. Shea stated that existing practices of engineering and manufacturing concerns and public organizations aggravate the scarcity of engineers.

More efficient use of engineers would justify higher pay rates, according to Mr. Shea, thus attracting back to engineering operations many of the thousands of graduates who have left the field to become salesmen, or to enter other fields where rewards seemed greater.

In describing common examples of inefficient methods, Mr. Shea pointed out the waste of time in such varied duties as answering telephones in engineering offices, writing reports which have to be written longhand when they might more readily be dictated, and in handling of catalogue files and making reference searches. By more extensive use of nonprofessional assistants for such work, the same duties could be accomplished with limited supervision. Many professional engineers now spend from 50 to 90 per cent of their time doing clerical work instead of engineering tasks. By concentrating clerical work with secretaries and office boys the productivity of engineers would be increased.

Mr. Shea claims that the fully trained engineer should do only engineering thinking, directing, inspection, and conference work. By adding non-engineering personnel to do minor tasks, two engineers could do the work for which four are needed now.

* * *

As an aid to new students who are sometimes confused by campus terminology we hereby present the following one-third column dictionary.

Slide rule—an instrument slightly resembling a 12 *in* ruler which is used primarily for back-scratching and mosquito swatting. On the slide rule are a confusing jumble of letters and figures. These are used purely for decorative purposes. The slide rule also has a movable centerpiece which facilitates its use as a pool cue.

File—a hardened steel instrument having cutting edges, or teeth. No other meaning or connotation of this word is tolerated on campus.

Textbook—a thick, heavy object carried to class by the engineer in order to strengthen his arm muscles. The price of text books at current exchange rates is about $1.99 per pound.

THE PRACTICAL ENGINEER
(*The first of a series*)

Kam's, Bidwell's, Katsina's—names of laboratories for the study of fluid flow.

Buried in the back page of one of last year's *Technographs* was a short paragraph on a slide rule contest at Texas A&M. The Aggies ran their contest something like this.

Every engineering freshman must take an engineering problems course. The top 10 per cent of the students in this course are selected to compete in the annual slide rule contest. At the contest each participant is given 60 problems to do in 50 minutes. The problems are generally somewhat like this one:

$$Y = \frac{(\tan 30°)^2 \sin 41°}{\sqrt{131}\ (\cos 14°)}$$

Both speed and accuracy are taken into account, so the winner is the man who gets the most problems right in the time allotted.

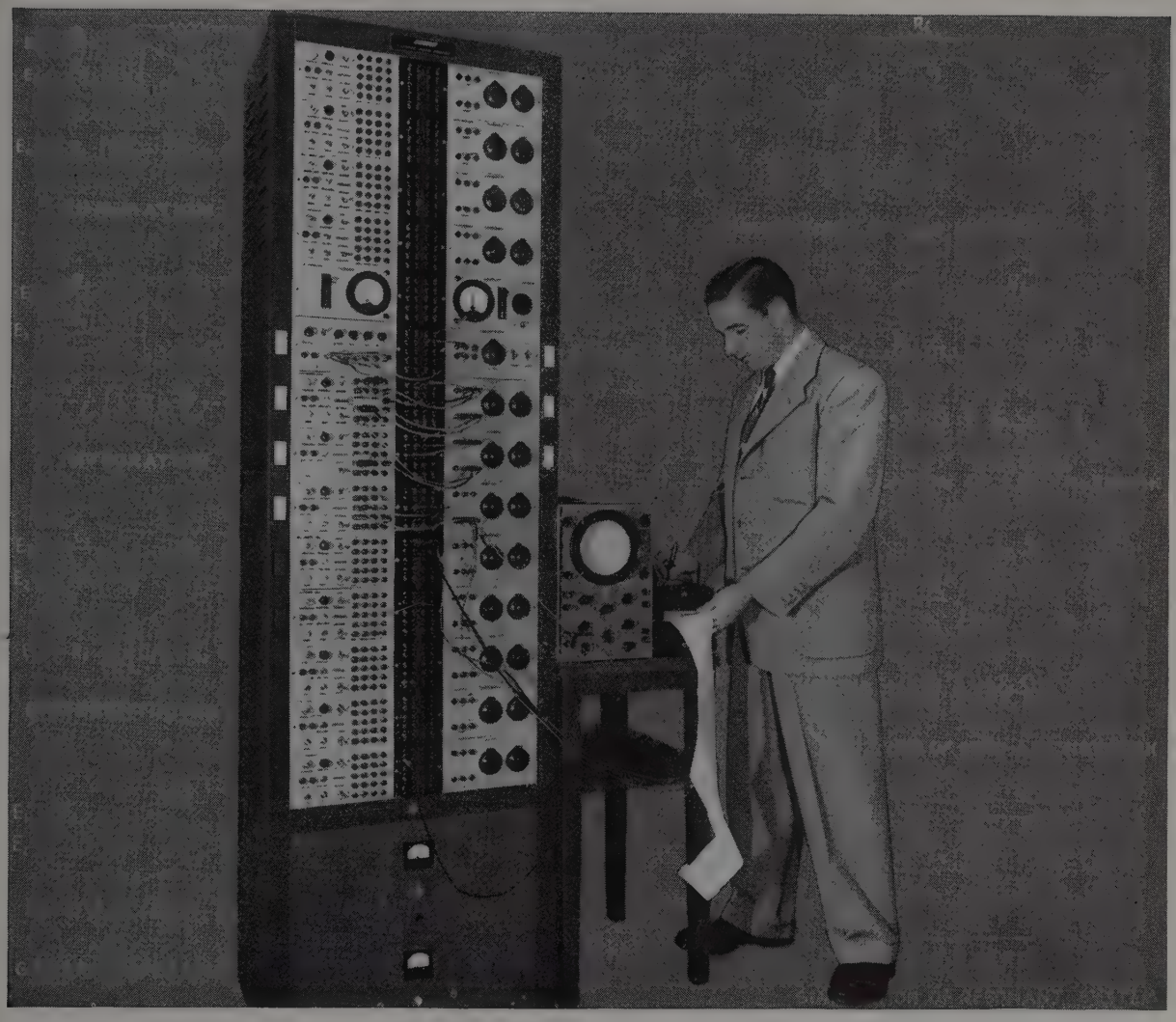
A contest like this would possibly work very well at the U. of I. It could be worked through Engineering 100 for freshmen, or sophomores could be included by making the contest available in some course which all sophomores take, such as Physics 103.

A slide rule contest would benefit engineering at Illinois in two main ways. First of all, it would stimulate freshman and sophomores to become proficient in using a slide rule. As it stands now, many freshmen and sophomores in engineering are complete strangers to the slide rule. Secondly, it would tend to promote *esprit de corps* in the engineering college. A slide rule contest may possibly prove impractical in the long run, but as of right now it seems like a good idea.

* * *

A rather cocky Sunday golfer looked toward the next green, waggled his driver confidently and declared. "That's good for one long drive and a putt." He gave his club a mighty swing, blasted up about two inches of sod, and managed to get the ball about three feet from the tee.

The caddy stepped forward, handed him the putter and suggested, "Now for one hellova putt."



Solving a dynamics problem with the Boeing Computer; oscilloscope at right shows result.

## What's it like to be a Boeing engineer?

Boeing engineers enjoy many advantages – among them the finest research facilities in the industry. These include such advanced aids as the Boeing-designed, Boeing-built Electronic Analog Computer shown in the picture above.

This is part of the stimulating background that helps Boeing men maintain the leadership and prestige of an Engineering Division that's been growing steadily for 35 years.

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You can work in Seattle, in the Pacific Northwest, or in Wichita, Kansas. You will benefit from in-plant training programs, from merit reviews that enhance advancement opportunities. You'll be part of a distinguished, long-range Engineering Division. You'll be proud to say, "I'm a *Boeing* engineer!"

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## VOCATIONS . . .

(*Continued from Page 7*)

However, three utilities have found it desirable to have ten or more. A score of the hundreds of farm electric cooperatives have found it profitable to use agricultural engineers to manage or assist in managing their operations.

One of the proven opportunities for an agricultural engineer is to get started in a substantial small business of his own, or to work into a partnership, in the distribution of farm equipment, building materials, and related items. Somewhere around one hundred ASAE members are owners, partners or employees in this type of business, and doing well at it. This is just enough to emphasize the need and opportunity for agricultural engineers in thousands of similar establishments.

Other lines of work and types of employment in private enterprise in which individual ASAE members have been successful, and have proven the value of their engineering training, add to the variety of opportunities for new employment and progress. They include farming, agricultural engineering work for large farms and for processors of farm products, management of individual farms, and of groups of farms on a consulting basis, consulting work on agriculture and engineering, the farm and trade press, trade associations, farm organizations, general contracting, and farm work and soil conservation contracting.

In public service, agricultural engineers are employed in a variety of agencies in addition to those directly concerned with teaching, extension, and research. Two ASAE members are employed by the United Nations.

In the federal government there are ASAE members employed in the Bureau of Public Roads and Bureau of the Census of the Department of Commerce; in the Geological Survey, and Bureau of Indian Affairs as well as the Bureau of Reclamation, Department of the Interior; in the State Department Institute of Inter-American Affairs; in the land, sea, and air branches of the Department of Defense; and in the Federal Land Banks, Public Health Service, Veterans' Administration, Federal Power Commission, Office of Education, and War Production Board. In addition to those in the Department of Agriculture, ASAE members are employed by the Farm Security Administration, Forest Products Laboratory, Office of Foreign Agricultural Relations, Office of Personnel, Weather Bureau, Regional Research Laboratories, and Farm Credit Administration, in addition to those in SCS, BPISAE, Extension Service, and the Office of Experiment Stations.

Among extra-governmental activities, the TVA is an established employer of agricultural engineers, and the Lower Colorado River Authority has already employed at least one.

In some of the states and territories, agricultural engineers are employed in agencies concerned with natural resources and with public health, and in state schools, as well as in the land-grant colleges and experiment stations and the extension service.

In still more localized public service, agricultural engineers are employed by some county engineering departments and by irrigation, drainage, and soil conservation districts. It appears that these agencies may justify and develop a considerably increased demand for agricultural engineering services. In Canada, the dominion government and the provinces employ agricultural engineers on a comparable basis in proportion to the extent of their agriculture.

On other continents, demand for agricultural engineering services has shown up in civilizations as old as those of China and Egypt; in governments as new as those of Israel, India, and Pakistan; and in regions as undeveloped as the Amazon River Valley.

The capacities in which ASAE members are employed range from trainees to presidents and chairmen of the boards of large corporations, corresponding high administrative posts in public service, and ownership of businesses of various sizes.

It seems to us that the basis of all this present and potential opportunity for agricultural engineers lies in a very significant fact. It is impossible to give intelligent consideration to any major phase, aspect, problem, or operation of agriculture without including consideration of its related physical factor. These physical factors—the environment of men, animals, and crops; the energies, dimensions, and operations involved; the very physical structure and properties of biologic materials—are the field in which engineering has proven the most effective technology and agricultural engineering the most effective specializatioen of that technology on behalf of agriculture. Opportunities for agricultural engineers will increase as recognition of the fact becomes widespread, and as agricultural engineers continue to add to their established record of service."

One of the jobs of the agricultural engineer is the conservation of the world's largest and most valuable known resource. Unlike our other known resources, such as coal, oil, minerals, and metals, the earth's cover of soil can be reused again and again, providing it is managed under proper care. From the soil comes all plant food and materials upon which all animal life is dependent. The value of soil as a resource cannot be estimated in units of earthly exchange, as it is the key to life itself. Agricultural engineers thus shoulder a tremendous responsibility in serving agriculture and all mankind. A shortsighted or selfish outlook can bring ruin and chaos. The social and moral code of an agricultural engineer therefore must be and is of the highest order.

The basic job of the agricultural engineer is to keep agricultural production abreast and in tune with the increasing and changing demands of the world without impairing or destroying its life-giving potentiality. Within a few decades we have advanced from human and animal power to mechanized power. As a result of our changing society, labor and raw materials have become the key to production and prosperity. The farmer thus finds human power too expensive and animal power too efficient. The present stage of development finds the mechanization of the basic production of agriculture well under way.

Today, in the United States, the largest population in our history is being supplied with the fundamental agricultural necessities of life by the smallest per cent of the nation's productive workers. Whereas, 150 years ago nine out of ten people followed agricultural pursuits and were required to keep the agricultural supply up with the demand for agricultural products. Today, one farm worker is able to feed and supply ten people and thus free them for work outside of agriculture. This great change has resulted in a diversified and rich national economy and has been made possible only by the application of engineering principles to the science of agriculture.

With the help of the agricultural engineer, the foundation of a civilization has been established which no longer tolerates the drudgery and burdens of an agricultural people. New farming practices and ingenius machines have enabled the tiller of the soil to enjoy a new standard of living. From a bare existence embodying hard work, long hours, illiteracy, and poverty, the farmer has progressed to his rightful place as a prosperous and educated citizen. The alert farmer of today is no longer bound by custom and habit. He can apply his own skill and talents to adopt and modify his farming program to make better use of the practices and tools available to him. The agricultural engineer has thus helped to release a new power, the power of a free and thinking agricultural people.

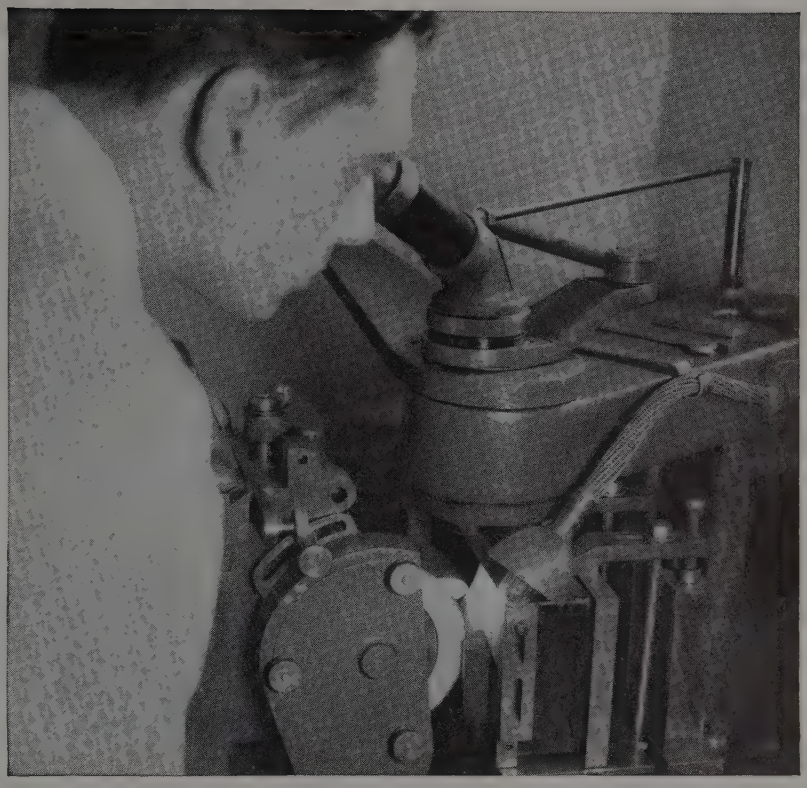
Agricultural engineers are today counsel to billions of dollars. Agriculture is definitely big business, with an average annual income of approximately sixteen billion, depending upon the yields and prices which may cause it

(*Continued on Page 30*)

# Who Is He?

- ☐ *a metallurgist*
- ☐ *an expert toolmaker*
- ☐ *a laboratory technician*

If you checked "toolmaker", you know your way around in a machine shop. He's grinding the contour of a carbide-tipped flat form tool on an optical-type precision grinder equipped with a Norton Diamond Wheel.



## *Facts You Should Know*

One of the reasons for the industrial edge the United States has over other countries is its leadership in the use of cemented tungsten carbide tools. With them, American industry has speeded up mass production.

Cemented carbide tools are so hard that they cannot be machined in their ultimate form by any known metal tool. So, they must be shaped by grinding with abrasive wheels.

Diamond wheels have become the accepted type of abrasive wheel for precision grinding operations on cemented carbides. Their exceptionally fast and cool cutting action and extremely low rate of wear result in economically low grinding costs.

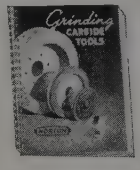
## *Norton Diamond Wheels*

Norton Company pioneered in the development of diamond wheels in this country, bringing out the first Resinoid Bonded Diamond Wheel in 1934. This was followed 5 years later by the durable Metal Bonded Diamond Wheel. And in 1945, came the Vitrified Bonded Diamond Wheel, a development of the Norton research laboratories.

Today, the Norton price list for Diamond Wheels and Hones contains about 1000 items, ranging in list price from $17.70 to $2,877.35, depending on the size of the wheel and the diamond content.

## *Think It Over!*

Because Norton Company is dedicated to "making better products to make other products better," Norton Research is always looking ahead. To the young technical man, such a progressive attitude promises an interesting future.




***Free Handbook On Grinding Carbide Tools*** describes in detail how Norton Diamond Wheels are used to recondition and sharpen cemented carbide tools and cutters rapidly and economically. Write for a free copy.

Joseph C. Danec, B. S. Ch.E., Lafayette College '39, examines a diamond wheel section with Bausch & Lomb Research Metallograph in connection with his work on the development of Norton Metal Bonded Diamond Wheels.

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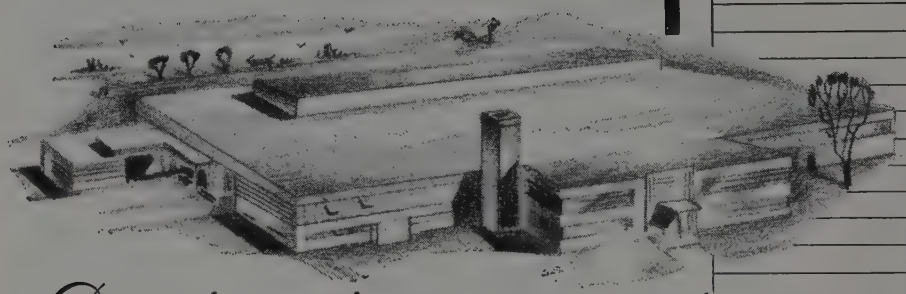

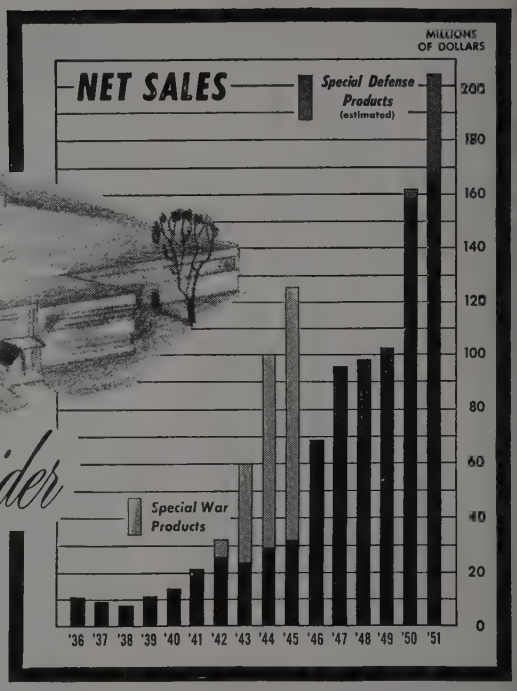


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# What's Happening at CRUCIBLE

## about tool steel forgings

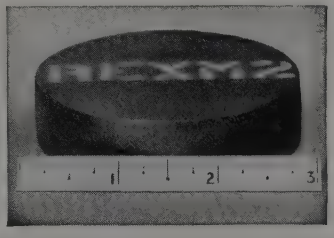
**Whether 1½ pounds or 7 tons . . . forgings get the same sensitive handling**

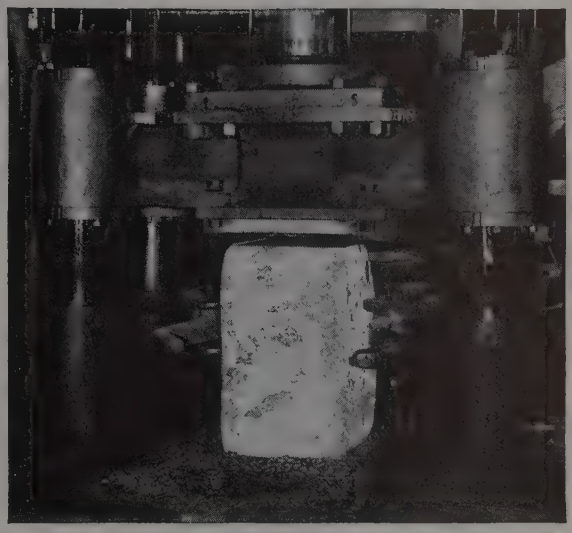
Crucible's reputation as the specialty steel leader is built on a devotion to the smallest detail . . . regardless of the size of the order.

These forgings are good examples of Crucible specialists at work:

### Rex M-2 High Speed Steel Disc Forging (1½ pounds)

Pancake forgings such as these are used extensively by small tool makers. Extreme care is taken in the preparation of the slug stock. The upsetting insures proper flow lines. Milling cutters, gear shavers and similar cutting tools that require maximum toughness, coupled with the best cutting ability, are made from these forgings.



### CSM-2 Plastic Mold Forging (14,000 pounds)

This CSM-2 plastic mold steel forging was made from a 25,000-pound ingot. This block will be heat-treated and worked to produce a mold for the manufacture of large plastic parts. The finished weight of the forging is 14,000 pounds. And it is the largest mold forging yet produced by Crucible.

### Engineering service available

Crucible's engineering service is geared to meet your research and development problems. If you use special forgings, or any special purpose steel, check with Crucible. Crucible Steel Company of America, General Sales and Operating Offices, Oliver Building, Pittsburgh, Pa.

**CRUCIBLE** first name in special purpose steels

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## AG. ENGINEERING . . .

( *Continued from Page* 9)

information on the application of engineering to a farming program.

The students of the department maintain an active local chapter of the student branch of the American Society of Agricultural Engineers. Each year the students in the department publish an annual which contains articles about the department and is used to keep alumni in touch with happenings in the department. Another purpose of the annual is to familiarize high school students with the department.

Students in the department take an active part in the Engineering Council and participate in the Engineering Open House activities and the St. Pat's Ball.

Students frequently ask themselves, "What careers will be open for me when I finish school?" Agricultural engineering has many career opportunities. The demand for agricultural engineers far outnumbers the available supply. The needs for engineers will not be met within the next five years. The majority of graduates choose engineering with industrial organizations, mostly with manufacturers of machinery and power equipment. There is a strong demand for men to fill positions in colleges and experiment stations for teaching and research. Government job outlets include the Soil Conservation Service, the State Soil Conservation Districts, and the U. S. Bureau of Reclamation. Recently a number of agricultural engineers have been employed as power-use advisers by electric companies. A few graduates are now in foreign service. Foreign opportunities range from export work to sales work. As an example, one U. of I. graduate is an assistant to the director of conservation in Israel. Nearly one-fourth of the graduates have continued with advanced work. Farming attracts a large number of graduates, both in operation of farms and as members of management organizations, seed companies, feed companies, and cooperatives.

Records on 115 graduates (not including the 1951 class) show that 49 are in engineering work with industrial organizations, 35 are in public service work with federal or state government agencies, 21 are in private business, either farming or commercial work, and 10 are in various occupations not known or unclassified.

About 45 per cent of all graduates are in power and machinery work, 18 per cent are in soil and water engineering, 14 per cent are in structures work, 17 per cent are in electrification and the other 16 per cent are unclassified.

Employers of agricultural engineers give a great deal of weight to farm background. Therefore, anyone interested in engineering who has had a farm background and a genuine interest in agriculture as well as engineering should certainly consider agricultural engineering as a possible profession.

---

Two glamour girls boarded a crowded street car, and one of them whispered to the other, "Watch me embarrass a seat from one of the men."

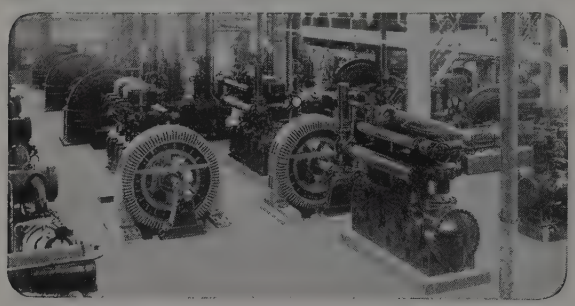
Pushing her way through the standees, she bore down on a gentleman who looked substantial and embarrassable.

"My deah Mr. Brown," she gushed, "fancy meeting you on the car. Am glad to see you—you're getting to be almost a stranger. Oh, am I tired!"

The sedate gent looked up at the girl he'd never seen before, and, as he rose, he said for all to hear: "Sit down, Bertha, my girl, we don't often see you out on wash day. No wonder you're tired. By the way, don't deliver the washing till Wednesday. My wife's going to the district attorney's office to see if she can get your husband out of jail."

* * *

A Scotsman was leaving for a business trip, and as he departed he called back, "Goodbye all, and dinna forget to take off little Donald's glasses when he isn't looking at anything."

**Celanese Corp. Uses 6420 Horsepower of Frick Refrigeration**

Fourteen Frick refrigerating machines are in operation at the Amcelle plant of Celanese Corporation of America, near Cumberland, Md., makers of chemical yarns. Most of these ammonia compressors have been in use since 1929. The motors driving the new vertical machines, shown in the foreground, are each of 1250 hp.

This is a large-scale example of the dependability and economy of Frick ammonia refrigeration. Power requirements, when operating in summer weather on air conditioning loads, are only 0.70 hp. per ton of refrigeration.

*The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, offers a career in a growing industry.*

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

**Books and Supplies**

***for every engineering need***

★

**ILLINI UNION BOOKSTORE**

★

**715 SOUTH WRIGHT STREET**

**ON THE CAMPUS**

Television joins the microscope in a major scientific advance, pioneered at the David Sarnoff Research Center of RCA, Princeton, N. J.

# Microbes star on Television

## in war against disease!

Until recently, scientists found it difficult to keep microbes alive for study—at high magnification—in light microscopes. Dyes, used to make them visible, killed some. Others were destroyed by the intense light.

RCA scientists have solved this problem by making television a working partner of the microscope. "Eye" of their new system is a tiny industrial television camera built around RCA's sensitive *vidicon* television tube. No intense light is needed, since this electron tube "sees" at extremely low light levels. And by making the tube sensitive to the red or violet bands of the spectrum, dyes and stains are eliminated.

**With RCA's system, research men can watch living germs or cells—immensely magnified—on the screen of a television set. Many are able to watch at a time. Students can be more easily trained. And science *learns more* about disease by watching *live* micro-organisms.**

Improving the microscope by teaming it with television is an example of the many paths explored by RCA Research. You benefit directly by better performance from any instrument or service of RCA or RCA Victor.

* * *

*See the latest in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, New York 20, N. Y.*

**CONTINUE YOUR EDUCATION WITH PAY—AT RCA**

**Graduate Electrical Engineers:** RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

*Write today to College Relations Division, RCA Victor, Camden, New Jersey.* **Also many opportunities for Mechanical and Chemical Engineers and Physicists.**

*RADIO CORPORATION OF AMERICA*

***World leader in radio—first in television***

RCA

## INTRODUCING . . .

(*Continued from Page* 10)

particular rugged breed of engineer known as the agricultural engineer. Here also, one might find the forerunner and the pioneer in the field of agricultural engineering who today create the pattern for our modern agricultural engineering curriculum. These men might be found at any time either conducting experiments for research projects or lecturing to a group of students.

One such pioneer in the field of agricultural engineering is Harry P. Bateman. Mr. Bateman started high school in Mansfield, Illinois, but after a year his family moved to Urbana. Here, at the Urbana high school, he completed his high school education.

Graduating from high school, he entered the University of Illinois agricultural school, which he graduated from in 1932. At this time a relatively new field had opened. It was called farm mechanics and was the forerunner of what we call agricultural engineering. Because of a scarcity of jobs in the field of agriculture, Mr. Bateman chose to return to school to study this new curriculum. In 1934, Mr. Bateman graduated in what was the first class to graduate in agricultural engineering from the University of Illinois.

After graduation he worked for two years with the soil conservation department at Macomb and Rushville. In 1936 he came back to Illinois to do research on power machinery of the farm which, at the time, was just coming into its own. In conjunction with farm machinery he worked with farmers in research on maintaining the efficiency of tractors. Another item that Mr. Bateman worked on was an attachme combines which would enable th harvest sunflowers. Sunflowers, i found, have a very high grade o The attachment was developed, bu flower production proved uneconor

HARRY P. BATEMAN

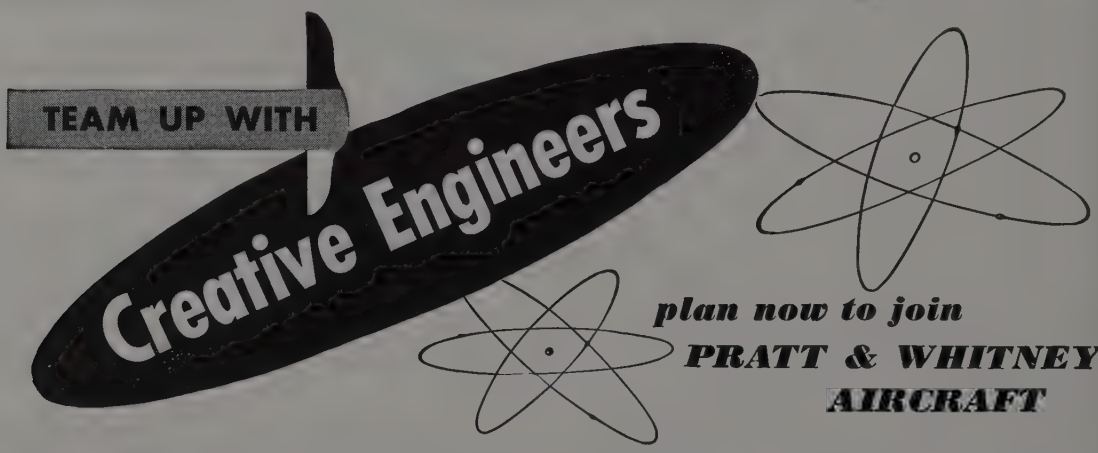
For the past two years Mr. Bat has been working at the new ag tural engineering experiment field v work has been done on corn pla and harvesting, corn shelling w combine, an adjustable corn picker a mulch planter. In 1948, Mr. Bat received his master's degree. A present time he is doing full tim search. During the war, howeve taught courses in Army personnel diesel engines for the Navy, here a University of Illinois. Mr. Bat has even taught GED 101.

Mr. Bateman's hobby is photogra He is an avid amateur photogra with his own dark room. He likes t color work and combines his hobby vacation trips.

---

The teacher had forbidden all the pupils from eating candy and c ing gum in class. One day she be quite suspicious when she saw a l lump in Jimmie's cheek. "Jimmie, you chewing gum or eating candy?" asked.

"Nah," replied Jimmie. "I'm soaking up a prune to eat at recess


FOR over a quarter of a century the Pratt & Whitney Aircraft Division of United Aircraft Corporation has depended upon *creative engineering* to bring its products to the forefront.

How well this idea has worked is amply demonstrated by the outstanding leadership record which Pratt & Whitney has established in both piston and turbine aircraft engine types.

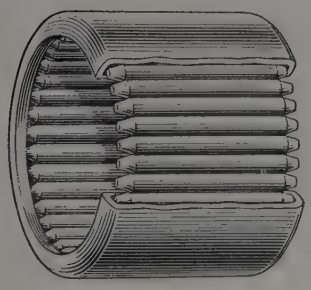
And for the future, because of its sound engineering background and research facilities, Pratt & Whitney is one of the few companies in the country to be selected to develop an atomic powered engine for aircraft.

Creative engineering will continue to be given top emphasis at Pratt & Whitney—and it might well be the best answer to *your* future too—if you want a chance to put *your own* ideas to work.

Why not find out where you could fit into this great engineering organization? Consult your Placement Counselor or write to Frank W. Powers, Engineering Department at

PRATT & WHITNEY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORPORATION
EAST HARTFORD, CONNECTICUT

# *The Torrington Needle Bearing is designed for high radial loads*



The many lineal inches of contact provided by the larger number of small diameter rollers give the Torrington Needle Bearing an unusually high load rating. In fact, a Needle Bearing has greater radial capacity in relation to its outside diameter than any other type of anti-friction bearing. This is illustrated in the table below, which compares the dimensions of three bearings with identically rated radial load capacities.

| | O. D. | I. D. | Axial Length |
|---|---|---|---|
| *Torrington Needle Bearing* No. B-1616 | 1¼" | 1" | 1" |
| *Ball Bearing* No. 405 | 3.15" | .98" | .83" |
| *Bronze Bushing* 3 sq. in area of bearing surface | 1⅞" | 1½" | 2" |

*Dimensions for three types of bearings, all having the same rated radial load capacity.*

## *Precision Manufacture and Unique Design*

The exceptional load capacity of the Needle Bearing is the result of proper selection of steels, precision workmanship to close tolerances, and the application of modern anti-friction principles.

The one-piece shell, which serves as the outer raceway and retains the rollers, is accurately drawn from carefully selected strip steel. After forming, it is carburized and hardened. There is no further grinding or other operation that might destroy the wear-resistant raceway surfaces. The full complement of thru-hardened, precision-ground rollers is retained by the turned-in lips of the one-piece shell.

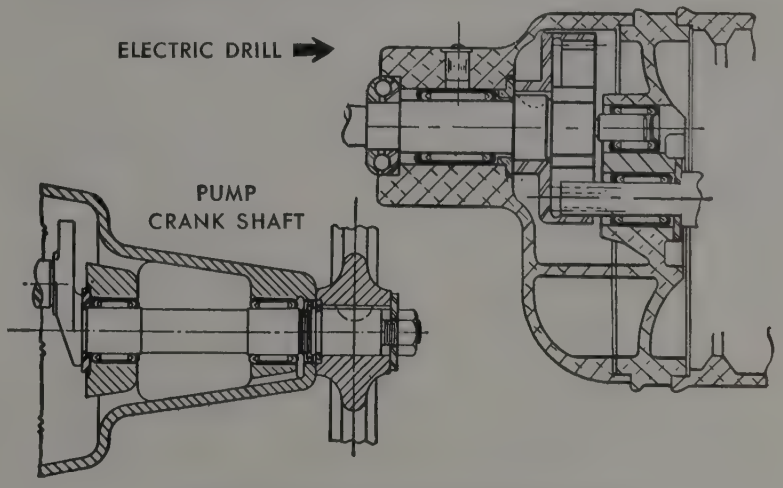
As the shaft is intended to serve as the inner race in most applications, it is hardened and ground to correct size. If an unhardened shaft is desirable, inner races can be furnished with the proper hardness.

## *Plus Features For Modern Design*

The unit design and compact size of the Torrington Needle Bearing provide other, related advantages which are being utilized in more and more applications.

The outer shell is easily seated by press fit into a straight bore housing, machined to the proper dimensions. No complex housing structures are needed — no spacers, retainers or snap rings required. And the compact size and light weight of the bearing itself also help make the end product lighter and less bulky.

Wherever high radial load capacity is vital, but space and weight are at a premium, Torrington Needle Bearings provide an ideal solution.




*High radial load capacity is vital in many bearing applications.*

Future advertisements in this series will discuss other specific advantages of Needle Bearings. If you would like further information on these or any other type of anti-friction bearings, our engineering department will be glad to be of assistance.

**THE TORRINGTON COMPANY**

Torrington, Conn. • South Bend 21, Ind.

District Offices and Distributors in Principal Cities of United States and Canada

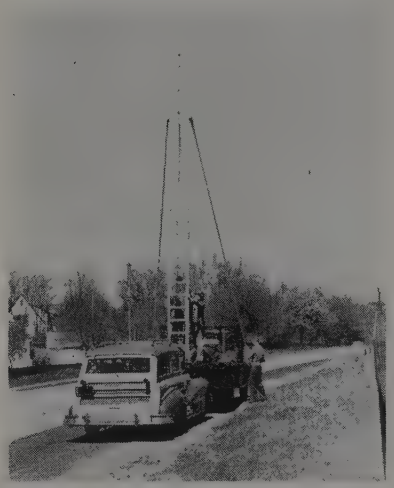
**TORRINGTON NEEDLE BEARINGS**

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • STRAIGHT ROLLER • BALL • NEEDLE ROLLERS

## UHFTV . . .

(*Continued from Page* 12)

trum. However, the trick in the real answer can be seen by considering for a moment the ordinary octaves used in the musical scale. The musical note "A," for instance, on the piano, has frequencies of 27.5, 55, 110, 220, 440, 880, 1760, and 3520 vibrations per second. Now each octave is defined as the difference between successive "A's," and as you can see, the last octave contains a



A mobile unit was used for checking UHF telecasts from the experimental station. (Courtesy of RCA)

wider range of frequencies than the entire six previous octaves. An entirely analagous definition holds for the radio spectrum. Thus only the higher octaves of the radio spectrum contain the necessary band width to support the tremendous amount of information which is broadcast by television stations. As a consequence, television occupies a total VHF band width of approximately the same fraction of an octave as it will in the UHF band, but UHF supports 70 television channels against 12 for VHF.

UHF, then, is destined to become the major band for telecasting. It will permit nationwide coverage by over 2,000 television stations, permitting cities of 50,000 and less to operate their own UHF stations. In addition, the tremendous band width available in this portion of the spectrum will permit broadcasting of much larger amounts of information than was hitherto possible. Color television, which ordinarily requires about a 10 megacycle band width, has been crowded into a 6 megacycle band by the ingenious methods of RCA scientists. But, for example, if three-dimensional television ever comes along, the amount of information which will have to be broadcast will be so large that these channels will have to be located even higher in the radio spectrum. Thus, development of the UHF band is a necessary step upward in the development and refinement of television broadcasting.

It was the Radio Corporation of America, in cooperation with the National Broadcasting Company, that first took the lead in the development of the UHF band for television. In the course of several years previous to 1948, manufacturers of television equipment had been conducting tests and experiments designed to further their knowledge about UHF television. Just previous to the FCC hearing in September of that year, RCA completed an extensive field test in Washington, D.C. At that time, it was decided by RCA that the only way in which to answer all the questions about UHF was to build and operate America's first ultra high frequency television station.

Bridgeport, Connecticut was chosen as the site of this station because of its location in the fringe area of reception between the New York and New Haven television stations, and because the hilly countryside provided an excellent opportunity to study the problems of transmission over unfavorable terrain. The actual location of the station is on "Success Hill," a rise of land 200 *ft* above sea level and two miles northeast of the center of Bridgeport. After the 1948 FCC hearing, preliminary details were quickly settled, and the project moved ahead rapidly. The transmitter building was completed on November 15, 1949, and a 40 *ft*, specially designed antenna was placed atop a 210 *ft* tower. Station equipment was designed by RCA and installed and operated by NBC under the call letters of KC2XAK, on 530 megacycles. The entire Bridgeport field experiment was arranged and supervised by Dr. C. B. Jolliffe, vice president and technical director of RCA.

This experimental station began broadcasting on Dec. 30, 1949, as the first and only VHF station to operate on a daily programming schedule. No actual programs originate from station KC2XAK. Instead, it is provided with a direct microwave link to WNBT in New York, whose regular programs over UHF.

RCA built and placed 50 experimental UHF television sets and 50 UHF adapters in various homes within the test area. These homes were selected so as to provide a fair sampling of reception conditions. In addition, some other manufacturers have taken advantage of this opportunity to test their own regular UHF receivers and adapters. Besides the receivers placed in the various homes in Bridgeport, a mobile receiving unit was installed in a station wagon by NBC, and used to check the reception and signal strength in practically

(*Continued on Page* 34)

## SKIMMING . . .

(*Continued from Page* 14)

much more stable arc over a wide range of current. Previous arc controls have been based on either current or voltage. The new one takes both into account. It responds to arc drop variations of $\pm 0.1$ volt or a current change as small as $\pm 0.1$ ampere. The new arc searchlight reaches a stable condition in two seconds; its predecessors required two minutes.

### autoradiography

The advent of atomic energy has greatly widened the field of autoradiography, the branch of photography where radioactive materials make their own shadow pictures.

Autoradiography is the technique of locating and measuring the amount of radioactive elements present in a material by means of photographic registration of the rays from the elements.

The technique has been used for years in the study of naturally radioactive parts of minerals such as radium, actinium, and thorium. As long as the radioactive elements were limited to the few that occur naturally, however, the field was limited. But use of the atomic

The beam candlepower of the new searchlight is rated at fifty million. (Courtesy of Westinghouse)

pile permits production of radioactive isotopes of practically all the elements of the periodic table.

By the use of radioactive isotopes in conjunction with photographic plates and emulsions, chemical elements can be traced in various substances, reactions, and processes. This is an extremely valuable tool for chemists, metallurgists, biologists, and petrographers.

In autoradiography, a photographic

(*Continued on Page* 36)

# Which is *Your* choice for the future?

• It takes all kinds of engineers to design, produce and distribute SQUARE D's broad line of electrical equipment.

• Throughout its years of expansion Square D's prime source of engineering talent has been schools such as yours. Not only electrical engineers. Mechanical and industrial engineers, too.

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**...for your copy of a 16-page "Get-Acquainted" brochure** which tells a lot about Square D, its products, services, markets and opportunities.

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## VOCATIONS . . .

(*Continued from Page* 18)

to drop to a low of six billion dollars or jump to a high of twenty-five billion dollars. The uncertainty of crop yields and animal production can be modified and eliminated to a greater extent today than ever before by the agricultural engineer and other scientists.

It takes an infinite amount of knowledge of a great variety to supply agriculture with the means and know-how for obtaining high yields of production and for scientific advancement. The agronomist, animal breeder geneticist, soil scientist, entomologist, etc., all occupy an important place in our agricultural and national economy. Regardless of the field of scientific activity, there are innumerable jobs which require and which would benefit from engineering application. For convenience, we might divide the problems involving agricultural engineering application into two general classes: (a) those which are created by nature, and (b) those created by man. Four of the greatest problems of nature might be classified as follows (without attempt to list them in the order of importance):

1. Inadequate or nonuniform distribution of precipitation.

2. Inundated lands or water logged soil.

3. Unseasonal changes in temperature resulting in frost.

4. The destruction or impairment of agricultural production due to pestilence, disease, and weeds.

The problems created by man are usually the result of his disobedience of the laws of nature, such as the problem of soil erosion and the depletion of water resources. Man's problems are also a product of his desire to raise his so-called standard of living by the advancement of the arts and sciences and by greater production of all his wants and needs with reduced expenditures of time and energy.

How far have we come in solving agriculture's problems? We have developed equipment and techniques for supplementing precipitation distributed by nature, but the areas in need have only been touched. By means of dams, dikes, ditches, drain tile, mole drainage, and soil manipulation, we have converted former worthless waterlogged soils into rich agricultural lands. Still, there are thousands of fertile acres to be reclaimed which leaves little excuse for resting. In our effort to prevent frost damage we have driven in a small wedge with smudge pots, oil heaters, fans, water sprays, and infra-red radiation heaters, but the damage to crops continues virtually unchecked.

The present day trend in which farmers are beginning to accept spraying and dusting equipment as standard tools of agriculture, much like the plow has just gotten under way. The use of such equipment promises to take much of the work out of one of agriculture's greatest problems, the eradication of unwanted plants, generally termed weeds. A word of caution might be inserted here, in that while this is desirable from the view point of production of specific products and food crops today, it may boomerang to destroy many plants which, while they have unknown use today, may be an important key to our economy tomorrow. At all times, the agricultural engineer must be alert and perceptive of the needs and wants of the future. In terms of plant disease and pestilence, we are still much further from the answer. The control or eradication of present known plant diseases seems to bring to light new and even more devastating ones. Plants and animals developed and shaped to man's whims will always be open to attack by the secret weapons of nature.

It is not difficult to perceive the many problems that nature presents for solution by the agricultural engineer. Nature is not an abeyant old lady as some people would like to dramatize here, but a very forceful, flexible, and creative creature.

Draws a line 1/10th of a mile long with
1 FILLING!
WORLD'S ONLY DRAWING INK FOUNTAIN PEN
with interchangeable nibs
Pelikan Graphos
Saves thousands of time-wasting pen filling operations for the artist or draftsman—insures uniform thickness of line from hairline to 3/8" thick. Ideal for lettering, freehand drawing, technical drawing, sketching, or stenciling with the interchangeable nibs. Graphos uses any drawing ink, black or colored. Handles exactly like any drawing pen — beautifully balanced, light touch. Time-tested—thousands in use in leading drafting rooms and art studios all over the world. Use the famous PELICAN WATERPROOF DRAWING INKS for best results.
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# Engineering Graduates

## CONSIDER YOUR FUTURE IN AIR CONDITIONING

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Trane, a leading manufacturer of air conditioning, heating ventilating and heat transfer equipment, is seeking qualified engineering graduates for interesting careers with its sales and home office staff.

Those selected will join the Trane Graduate Training Program at La Crosse for an intensive training course that will prepare them for responsible positions in La Crosse or in one of the company's 80 sales offices. The training period is financed by the company to make the trainee self-supporting.

Men who have completed the Trane Graduate Training Program have established an interesting pattern of success with the company. Included in this number are the president and numerous other company officers, managers of a majority of the sales offices and home office sales divisions.

Trane has continued to grow steadily and at a rate consistent with financial stability. Annual sales have increased fourfold in the last ten years. Yet, the company continues to develop new products for new fields to increase its potential business opportunities.

Based on past record and future possibilities, Trane offers you outstanding opportunities in one of the fastest growing industries. For more information write for the brochure "The Trane Graduate Training Program." It contains full details as well as a complete financial report of the company.

**THE TRANE COMPANY**
**LA CROSSE, WISCONSIN**

## how weak?

Oxygen . . . the basic element of life. It breathes life into premature babies . . . plucks the sick from the grave . produces steel . . . helps build bridges, planes, ships. It is the partner of man — and industry.

## how strong?

The oxyacetylene flame and electric arc . . . an unbeatable team for building tools of war — and peace. Economical . . . versatile they cut and sew metals into strong, one-piece units.

AN AIR REDUCTION PRODUCT

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From oxygen for incubators to oxyacetylene flame cutting . . . from gases for beverage carbonation to sign lighting . . . from steel making to synthetics, you'll find Air Reduction products contributing to the comfort and convenience of daily life.

Results of continuous research and development, these products are but small parts of Air Reduction's family of materials and processes aimed at filling tomorrow's needs and the requirements of today.

In fact, wherever progress is racing ahead to new frontiers, you'll find an *Air Reduction Product.*

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Divisions of Air Reduction Company, Incorporated, AIR REDUCTION SALES COMPANY, AIR REDUCTION PACIFIC COMPANY, AIR REDUCTION MAGNOLIA COMPANY... *Industrial Gases, Welding and Cutting Equipment* • AIRCO EQUIPMENT MANUFACTURING DIVISION • NATIONAL CARBIDE COMPANY... *Calcium Carbide* • OHIO CHEMICAL & SURGICAL EQUIPMENT CO., OHIO CHEMICAL PACIFIC COMPANY... *Medical Gases — Apparatus — Hospital Equipment* • PURE CARBONIC COMPANY ... *Carbonic Gas and "Dry-Ice"* • AIRCO COMPANY INTERNATIONAL... *Export* • AIR REDUCTION CHEMICAL COMPANY

## UHFTV . . .

(*Continued from Page* 28)

all sections of the area serviced by the station.

In order to obtain a direct comparison between the performance of a UHF and VHF television station, NBC built and operated a small VHF transmitter with the same antenna elevation as that of KC2XAK. From the simultaneous operation of both transmitters, valuable graphs, charts, and diagrams proving the capabilities and performance of UHF in comparison with VHF were continuously prepared. This information was turned over to the FCC as fast as it was collected and distributed to the entire television industry.

"Operation Bridgeport" was brought to a dramatic climax in September, 1951, when the entire test was summarized and the report made available to the public. The crystallization of two years of testing into one comprehensive study brought out conclusive evidence that a major television expansion is both practical and possible within the UHF band. In particular, four points of special interest to the public were proven by these tests.

Television reception on UHF can be just as clear and stable as on VHF. In some instances it is even better, for UHF pictures are not bothered by nearby X-ray equipment, auto ignitions, neon signs, or home appliances, which often distort and otherwise disturb VHF pictures.

Present television sets made by most of the leading manufacturers can be readily adapted to receive both UHF as well as VHF telecasts. Many manufacturers have already demonstrated simple UHF converters which can be readily attached to present sets.

Actual construction costs for a UHF broadcasting station will be about the same as for a VHF station. In addition to making more channels available for TV, there is also the possibility with UHF of operating a UHF station as an auxiliary of a major VHF station. Or it could be operated as a network station which would receive and rebroadcast the network programs instead of operating as a local station. This would eliminate costly studio equipment, mobile units, and extra personnel.

However, VHF will remain the backbone for television service in large cities, since it has fewer "shadow" areas in coverage and these, in most cases, can be overcome by satellite auxiliaries. UHF stations have limitations, including the requirement of more power for a given area, and deeper shadows or localities receiving no signals. UHF, then, will be most useful in areas where the VHF band is completely filled.

Thus, due to the tremendous advances in UHF during the past few years, a truly nationwide television service has become a promised reality. Foreseen only a few years from now is the time when over 2,000 television stations will dot the nation, entertaining some 50 million viewers with large, network style programs. And as these and other possibilities come before us, there emerges a view of vast new horizons, so promising that they make the present stage of television appear as little more than the beginning.

---

The mental patient was about to be released after twenty years of incarceration. He put on his best suit, then decided to shave himself. As he stood before the mirror, razor in hand, a nurse passing by called out, "Good luck, Harvey."

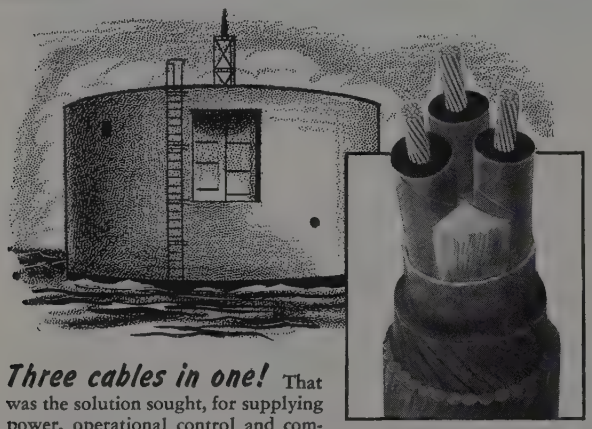
As he turned to answer her, the razor caught in the string supporting the mirror and it slipped to the floor. The patient turned around and found himself gazing at the blank wall.

"Darn it," he mumbled, "just my luck. Just as I'm ready to leave here after twenty years I cut my head off."

* * *

"I tell you I never saw such a fish. It was that long."

"I believe you."

***Three cables in one!*** That was the solution sought, for supplying power, operational control and communication to a pumping house 4½ miles off shore in Lake Okeechobee, Florida.

As usual, Okonite engineers were consulted on the problem. Their studies showed that it was possible to combine a three-fold function in one cable. This was accomplished by the use of Okolite high-voltage insulation whose electrical characteristics permitted carrier current to be superimposed on the power conductors.

The result was a single Okonite-insulated cable — steel-armored for the 4½ underwater miles, with a non-metallic sheath for an additional 2½ miles underground — which supplies not only power and operation control, but a communication circuit as well.

• • •

Tough jobs are the true test of electrical cable . . . and installations on such jobs usually turn out to be Okonite.

OKONITE *insulated wires and cables*

8787

*Chemical*

ENGINEERS

★

*See Your Department*

*Featured*

*in Next Month's*

★

TECHNOGRAPH

# Will we ever run out of gas?

RUNNING OUT of the crude oil that powers and lubricates our civilization is not an immediate danger. Scientific methods of exploration, drilling, and recovery keep pushing farther and farther into the future the day when petroleum must be supplemented by other raw materials. When that day comes, however, there is no danger that the American economy will slow down.

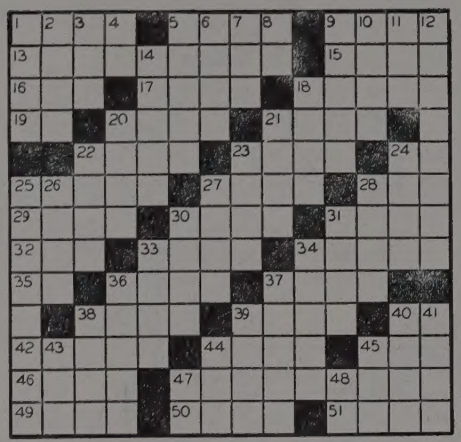
Standard Oil already knows how to make high-quality gasoline from coal or oil shale. The supply of these raw materials is far greater than the reserves of petroleum. It is important that the research and development work in the entire field of synthetic fuels continue so as to lower the cost and raise quality still higher.

Work with synthetic fuels is only one example of how Standard Oil plans ahead to serve its customers. By working to keep this company in the forefront of one of America's most competitive industries, our researchers and engineers are helping to keep America itself ahead and to make life better for every American.

## Standard Oil Company

STANDARD

**(Answer on Page 40)**



**ACROSS**

1. Narrate
5. In addition
9. Seth's father: Bible
13. Published his first paper on laws of hysteresis in 1891
15. Tree of southern U. S.
16. Too
17. Mind
18. Rust-resistant alloy of nickel, copper, etc.
19. Element discovered by the Curies: chem. symbol
20. State
21. Support for overhead wire
22. Row
23. Invented the automatic block system for railroads, in 1867
24. Musical note
25. An electric heater dispels this fast
27. Better conductor of electricity than copper
28. Large hardwood tree
29. Belonging to us
30. Box
31. Scandinavian epic poem
32. Individual
33. Viennese who helped develop the tungsten-filament lamp
34. Radon
35. Army officer: abbr.
36. Hebrew letter
37. Fish's appendages
38. What a video audience does
39. Rounded projections
40. Accomplish
42. Discourage
44. Shove
45. Distant
46. Metric weight
47. Developer of frequency modulation
49. C. G. S. work units
50. Replica
51. Patented the "telautograph" in 1893

**DOWN**

1. Former Russian ruler
2. Sicilian volcano
3. Guided
4. Chinese distance measure
5. Fossil resin, strongly electrified by rubbing
6. Ogle
7. Pig's home
8. Small weight: abbr.
9. Coral island
10. Eat a banquet
11. Corroded
12. First to measure the electric charge of an electron
14. Book of fiction
18. Fungus yielding penicillin
20. Is sick
21. Pallid
22. Fatigue
23. Landlord of an inn
24. Starch used in puddings, etc.
25. Developed the cathode-ray tube in 1927
26. Search
27. Slit
28. Grain popular in Scotland
30. Severs
31. Moral lapses
33. Scoff
34. A state of darkness
36. Abounds
37. Finical
38. Male deer
39. Chunk
40. Developed the "dip needle" in 1827
41. Carousal
43. Go astray
44. In favor of
45. On behalf of
47. Popular form of electricity: abbr.
48. Football position: abbr.

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*Drafting, Reproduction and Surveying Equipment and Materials, Slide Rules, Measuring Tapes.*


## SKIMMING . . .

(*Continued from Page* 28)

emulsion is placed in contact with a tes sample of material and self-portrait o the surface registered by means of th emanations from the radioactive atom in or near the surface.

If the surface is highly active, th picture may consist of a series of den sity values, as obtained in an ordinar photograph. In a sense, such picture are like a contour map. The variou densities of the negative indicate the in tensity of radiation at each point o the surface and, therefore, the amoun of radioactive material present.

When the radioactive atoms in th material are very sparse, an accurat microscopic survey of the contactin emulsion can be made after develop ment and the concentration of radio active atoms determined from track counts.

The survey method is tedious, but i permits very great sensitivity. It ha the advantage under certain circum stances of giving very great resolvin power since the origin of the tracks ca be localized within about 1/10,000 o an inch.

Emulsions of various sensitivities t beta radiation have been made avail able for autoradiography. Usually th highest speed emulsion suitable for desired resolving power is chosen for particular job. The fast emulsions hav large grains and low resolving power The fine grain emulsions have good re solving power but low speed.

## sterilization of blood plasma

Blood plasma, for the treatment o military casualties as well as civilians may soon be sterilized with high-energy electron rays more efficiently than with methods now employed. Blood plasma is one of the many materials on which electron or cathode ray sterilization might be used effectively.

The major advantage of cathode rays in killing germs and molds is that such sterilization may be accomplished without heating the material. This is particularly important for certain drugs and other products, that might be damaged by heating.

Ultraviolet rays are now employed for sterilization of blood plasma. While these rays do not heat the plasma, they do not penetrate into it as deeply as would the high-voltage cathode rays. Thus sterilization with electrons might be more efficient.

Further laboratory work is needed in order to make sure that cathode-ray treatment of blood plasma does not cause the formation of any poisonous compounds.

This type of sterilization can also be used to sterilize foods such as meats, vegetables, bread, honey, and many other products.

# Security

A FAMILY had failed to make a living on a worn-out New England farm. Did they demand government subsidies, checks for crops they didn't raise, high prices for crops to be burned?

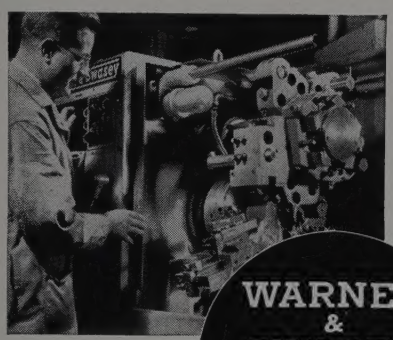
They would have scorned such things—scorned and feared, for they knew from days under a foreign despot that where government *money* goes, government *control* goes, too.

No, this family put everything they owned in that wagon, and *walked* beside it 2,000 miles, westward. They didn't know what was ahead, but they were determined to keep on going until they found a place of freedom where they could keep their self-respect.

They were English, Scotch, Dutch, Italian, French—people from many places—all, now, Americans. They knew that the only happiness is from self-respect, and the only way to self-respect is to earn your own way, not whine for something for nothing.

Their sons and grandsons started grocery stores, became mechanics, saved their money and started factories. American machines bought by American thrift made the factories grow.

And that's America. Made by people willing to walk 2,000 miles beside a wagon—to find opportunity. If such people are gone, if all we've got left are soft weaklings who want to be taken care of, then in truth American manliness is dead, that 2,000 mile walk was wasted, and there is nothing left of America but a hollow shell.

WARNER & SWASEY
*Cleveland*
Machine Tools
Textile
Machinery

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

Professor Zotz was a sworn enemy of coeducation. "It's impossible," he told a group of friends, "to teach a young man mathematics if there's a girl in the class."

"Come now, professor," someone objected, "surely there must be an exception to that."

"There might be," snapped Zotz, "but he wouldn't be worth teaching!"

* * *

A sweet old lady, always eager to help the needy, spied a particularly sad looking old man standing on a street corner. She walked over to him, pressed a dollar bill into his hand and said, "Chin up."

The next day, on the same corner, the sad old man shuffled up to the lady and slipped ten dollars into her hand.

"Nice picking," he said in a low voice. "Paid nine to one."

* * *

Two Air Force men watched a plane unload at a Korean air field. "Look at the terrifying insignia on the side of that plane," one exclaimed.

"Shhhhh. Not so loud," the other warned, "that's the squadron commander looking out the window."

* * *

As the conductor called out the various names of the streets, the country couple became more and more uneasy. The conductor called "Maple," then "Adams," then "Rosewood." The country man grew very fidgety and, turning to his wife said, "Isn't it time we got off."

"Don't show your ignorance, Matthew," she said. "Wait until your name is called."

* * *

Arriving home earlier than usual, hubby found his wife in the arms of his best friend. Said the interloper: "I love your wife and she loves me. I'll play you a game of cards for her. If you lose, I want you to divorce her and I'll marry her. If I lose, I promise never to see her again. Will you play a game of gin rummy for her?"

"Yes," replied the husband, "and how about playing a penny a point to make it interesting?"

* * *

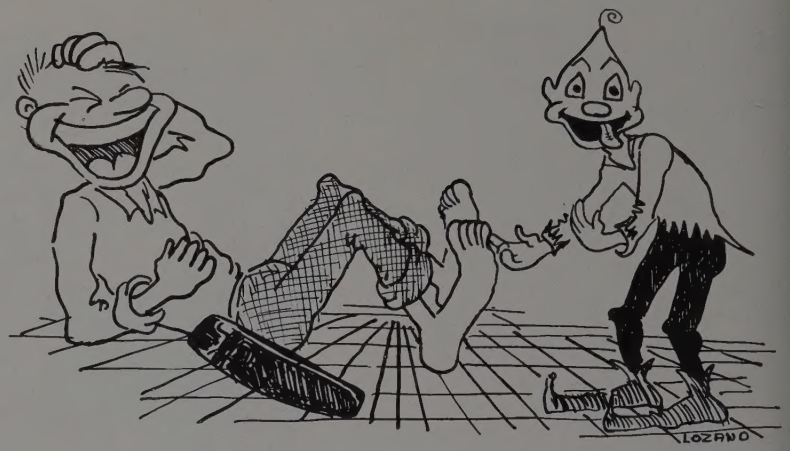
A man was passing a neighborhood store and heard such a terrific racket, he decided to investigate. He found no one in the place but the proprietor.

"Whom were you arguing with in here?" he asked. "You're all alone."

"I get bored," explained the proprietor. "So I talk to myself."

"Well," the man reasoned, "if you talk to yourself why do you have to argue?"

"Because," the owner retorted, "I can't stand a liar!"




# TECHNOCRACKS

Engineer's Voice (over the phone): "Say, Mable, may I come over tonight?"

Coed's Voice: "Sure, Pete, come on over."

Engineer's Voice: "Why, this isn't Pete."

Coed's Voice: "This isn't Mable, either."

* * *

He (at movies): "Can you see all right?"

She: "Yes."

He: "Is there a draft on you?"

She: "No."

He: "Seat comfortable?"

She: "Yes."

He: "Mind changing places?"

* * *

The mayor had just laid the cornerstone for a new wing of the hospital, and the spectators awaited his speech.

"What can I do, Mary?" whispered the Mayor to his wife. "My speech! I've laid the cornerstone on top of it."

* * *

I want my peas with honey, and,
like I tell my wife,
They do taste kinda funny, but it
keeps them on my knife.

* * *

**Crossword Answer**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | E | L | L | ■ | A | L | S | O | ■ | A | D | A | M |
| S | T | E | I | N | M | E | T | Z | ■ | T | I | T | I |
| A | N | D | ■ | O | B | E | Y | ■ | M | O | N | E | L |
| R | A | ■ | A | V | E | R | ■ | P | O | L | E | ■ | L |
| ■ | ■ | T | I | E | R | ■ | H | A | L | L | ■ | S | I |
| C | H | I | L | L | ■ | G | O | L | D | ■ | O | A | K |
| O | U | R | S | ■ | C | A | S | E | ■ | S | A | G | A |
| O | N | E | ■ | J | U | S | T | ■ | N | I | T | O | N |
| L | T | ■ | T | E | T | H | ■ | F | I | N | S | ■ | ■ |
| I | ■ | S | E | E | S | ■ | L | U | G | S | ■ | D | O |
| D | E | T | E | R | ■ | P | U | S | H | ■ | F | A | R |
| G | R | A | M | ■ | A | R | M | S | T | R | O | N | G |
| E | R | G | S | ■ | C | O | P | Y | ■ | G | R | A | Y |

**(Puzzle on Page 36)**

The minister had been asked to present the prizes to the winners of the local dog show, but when he got there he was outraged at the dress of some of the girls.

"Just look at that young person there with the cigarette, close-cut hair, and breeches," he cried to a bystander. "Is it a boy or a girl?"

"It's a girl," replied the other. "She's my daughter."

"Oh, forgive me, sir," apologized the preacher, "I never dreamed you were her father."

"Im not," was the reply, "I'm her mother."

* * *

Bachelors know more about women than married men. That's why they're bachelors.

* * *

In a secluded corner of their club, a film actor was being berated by his wife. "You mean skunk," she announced. "Of all low-down reptiles I think you are the worst!"

The actor, noticing that a group of friends had taken a table within earshot, quickly broke in, "Quite right, dear. And what else did you say to him?"

* * *

A Russian lecturer who insisted that democracy worked only for a few was asked to explain a photo of an American parking lot crowded with cars.

"Aha, look at the hub caps," he said. "Most of them are owned by one fellow—Chevrolet!"

* * *

"An inmate just escaped from an asylum. He was tall, thin and weighed 250 pounds."

"Tall, thin and weighed 250 pounds?"

"I told you he was crazy."